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IRON-STARVATION IN RUMINANT STOCK.

CORRELATION WITH LAND FEATURES IN THE PUMICE SOIL-PROVINCE.*

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IT has been exhaustively demonstrated by B. C. Aston in this *Journal*† that the proximate cause of so-called "bush sickness" in ruminant stock is a shortage of iron in the animal, conditioned by an inadequate supply of iron in the pasture upon which the trouble develops. When, however, an attempt is made to trace the cause of this insufficiency of iron in the pasture to some single factor of the plant environment it is usually found that the evidence is so conflicting as to make any hypothesis untenable. It would thus appear that there are several sources of the trouble, all of which are necessary to its existence, at least in any marked degree.

Analysis has shown that the soils upon which iron-starvation develops are all well leached, and do not contain any appreciable quantity of solids, such as lime carbonate or manganese dioxide, likely to be antagonistic towards the availability of iron to the plant. (See, however, reference to excessive oxygen later in this article.) It is probable, then, that the low degree of absorption of iron by the plant is due to a real lack of available iron in the soil, arising from an abnormal combination of factors which will not allow conditions to exist favouring the full assimilation by the plant of iron which is naturally in the soil.

The factors at present indicated as being involved are: (1) An altitude for the surface soil sufficiently above the permanent soil water table to prevent the rise of ground water from the latter by capillary attraction, to the surface; (2) a soil of texture coarser than a sandy loam—*i.e.*, not containing more than about 5 per cent. of clay (nor alternatively sufficient humus to compensate); (3) a subsoil and substrata fairly pervious to water; (4) a fairly heavy annual rainfall; (5) an approximately horizontal, undissected type of topography; (6) an absence of seepage areas (this really follows as a corollary).

* In soil-survey classification the term "soil province" denotes an area of country having the same general physiographic features and in which the soils have been produced by a common force or group of forces.

† See in particular Vol. xxviii, Nos. 4, 5, 6, and Vol. xxix, Nos. 1, 2, 1924.

From a large number of observations and analyses it appears that at least the first five factors must be present before iron-starvation can develop, at least with any intensity. Each factor will now be considered separately.

(1) The altitude of the surface above the permanent ground water level must be sufficiently great to prevent any return, by capillary action, of soluble iron salts leached out of the surface soil during dry weather. This can usually be detected by observing the condition of the soil and pasture during periods of drought. This aspect of the trouble has already been noticed by Aston in the *Journal* for January, 1925, page 2, when discussing the difficulty of reconciling the fact that soils of identical mechanical composition may respond differently as regards their influence on the occurrence of iron starvation. Referring to an area at Kaharoa, in Rotorua County, he states: "Where there are no springs the trouble appears, but where there is plenty of spring or creek water the stock are said to be perfectly healthy. Thus at the extremity and lower portion of these two blind roads the cattle-sickness is unknown. The writer considers this as being a parallel to the well-known case of the lake-side paddocks (see this *Journal*, p. 370, December, 1924) and the bush-sick areas up on the hills. Where the soil is kept well saturated with water by seepage from springs or by the rise of subsurface water there is no sickness, and where the soil is dependent on rainfall the soil-water so soon drains away that there is not sufficient to act as a carrier of mineral plant-food from the soil to the plant-roots."

(2) It appears that when more than 5 per cent. of clay (or alternatively sufficient humus to compensate) is present in the soil, the latter becomes sufficiently impervious to so diminish the ratio of soakage to run-off of rainwater as to greatly retard leaching and the associated oxidation from dissolved oxygen. Under such conditions soluble or available iron salts can be developed and retained in the soil (probably mostly in the ferrous form). The best example of this is on the Patetere Plateau, near Mamaku. Aston, in this *Journal* for November, 1924, p. 334, states: "A feature shown by the Mamaku soils is the constant mechanical composition over a very large area. The analysis suggests that within a radius of two miles and a half from the Mamaku Railway-station there is no change except in isolated patches similar to that represented by soil-sample No. S 60. This country all bears, or has borne, a virgin forest of tawa and rimu. Travelling north, as one gets near the Oturoa Road, about five miles from Mamaku, an improvement is noticeable in the texture of the soil, which is much heavier, the coarse pumice being buried under finer material than that which occurs near Mamaku. A little to the north of the Oturoa-Rotorua Road the beech ('birch' of the settler) forest of the Mangorewa-Kaharoa Block is encountered, and here the soil is so perceptibly finer as to necessitate a new name, being now a 'sandy loam' instead of a 'sandy silt.' The former weighs 10 per cent. more than an equal volume of the latter."

(3) A semi-impervious substratum near the surface (such as an alluvial silt or a pan) will check the downward flow of water, encouraging an increase in run off and the development of springs and swamps, conditions favouring the availability of iron.

(4) It is evident that with a porous soil the heavier the rainfall the greater will be the leaching. In this connection it is interesting to note that iron-starvation usually appears to be most prevalent during very wet seasons.

(5) If the topography be one of sharp ridges and valleys, or of steep slopes generally, it is evident that leaching will be modified in two distinct directions: (*a*) The ratio of soakage to run-off will be lowered, less water sinking into the soil or else sinking through in more restricted areas; (*b*) water that does soak through and leach the higher levels will frequently seep out again, bearing its load of soluble material to the roots of the pasture plants at lower levels. It is on wide flat-topped hills, terraces, or plateaus, where soakage disposes of most of the rainfall and seepage areas or permanent swampy conditions are absent, that the trouble develops in its most acute form.

(6) Where the nature of the topography and subsurface strata allow of the development of seepage areas, or of springs and streams bordered by swampy pasture, even in relatively small areas, it appears to be quite general that stock having access to such do not develop the trouble; or, if so, to an extent diminishing with increase in the relative proportion of seepage or wet to leached soil pastures. If springs are localized or streams sharply entrenched so as to leave no room for wet, seepage, or unaerated soil pasture, they are usually found to affect the incidence of the sickness but little.

In a case, therefore, where iron-starvation manifests itself in an acute form the following conditions will typically be present: The location will be fairly high above the level of permanent water, the topography of a flattish or hummocky type, the soil of a type coarser than a sandy loam (sandy silt, coarse sand, fine gravelly sand, &c.) deficient in clay and humus, probably well leached, oxidized and low in iron content, the substrata of a pervious nature, and the rainfall fairly high.

Under such conditions there is a continuous downward movement of rainwater through the soil, carrying with it soluble material, including iron, which the colloidal material—clay and humus—is insufficient in amount to retain. At the same time much oxygen is supplied to the soil dissolved in the rain-water, tending to keep iron compounds in the more highly oxidized ferric form, which, except in extremely acid conditions, is insoluble and not available to the plant. An excellent instance of the leaching of iron and manganese from the pumice soil under favourable circumstances is given in this *Journal* for December, 1924, p. 372 (with a photograph), as follows: "At the railway quarry near the Rotorua Railway-station, at some quite recent date geologically, marshy conditions must have prevailed, the result being that a large amount of the iron and manganese was leached out of the first few feet of pumice and redeposited where the subsoil became much coarser. The dark nature of the underlying stratum is caused by the coating of the pumice gravel with oxides of iron (brown) and manganese (black) which have been leached out of the top soil." (Aston.)

In a normal soil the colloidal clay acts as a buffer surrounding particles of decaying vegetable matter (or humus) and protecting them from oxidation by the air or oxygen in rain-water. Under such conditions the particles exert a reducing action on the iron oxides or hydrates of

the soil, converting them into the more soluble ferrous form. In many cases this action is too intense, ferrous compounds in an excess poisonous to many plants being produced. This condition is to be seen in many swampy areas where the subsoil is found to be a blue or green colour, due to the ferrous iron, contrasting with the yellows or reds of normal soils, in which most of the iron is in the ferric state. Only a small fraction of the total iron is required to be in this reduced or ferrous condition for the pasture (and the animal) to receive its normal ration, but in "bush-sick" soils even this amount is apparently not found. Direct oxidation of reducing material in the soil is able to proceed, very little reduction of the ferric compounds occurring, and what does occur being rapidly leached out.

Some examples of how the various factors operate together to produce the different degrees of iron-starvation actually observed may be given. On portions of the Kapakapa Road, and at Te Pu and Ngawaro (Rotorua County), perhaps the most acute degree of the sickness is manifest. All the factors enumerated are present (see this *Journal* for January, 1925, p. 2). The situation is relatively high above permanent water, the soil is a fine gravelly sand or a coarse sand, the substrata are pervious, consisting of sands and tuffs, the topography that of a plateau or gently valleyed and hummocky, and the rainfall heavy, resulting in a leached soil and an absence of springs and seepage areas.

At Mamaku the chief factor modified is the texture of the soil, which is sandy silt rather finer and less pervious than the soils mentioned above. Sickness is less acute but still severe.

At Oturoa the soil is finer, being a sandy loam, and the altitude less. Springs and creeks occur. Sickness is absent or of a light degree.

Farms at the ends of Kapakapa and Kaharoa Roads, and in parts of Ngawaro and on the northern side of Rotoiti Lake, are either free or exhibit only a mild form of the trouble. The soils and other factors are practically the same here as in other parts of the Kaharoa and Ngawaro districts, with the exception of topography, which is usually found to be well dissected, with springs, swamps, seepage areas, and streams.

At Hamurana, and generally on the low-lying land bordering the lakes, not only is no sickness found, but sick animals from other areas recover quite rapidly. The soils vary from sandy silts to fine gravelly sands, and the only modified factor appears to be the altitude above permanent water, which is often but a few feet or even inches, and in winter some land may be submerged. Springs, seepage areas, and swamps occur from under the hills and higher terraces to the lake edge.

The higher terrace lands, which are intermediate in altitude and position between the low-lying healthy lakeside soils (as at Rotorua) and the high sick soils (as at Mamaku) are also found to be intermediate as regards the incidence of sickness.

At Te Ngae, Okareka, and other places where sufficient thickness of the 1886 Rotomahana eruption mud remains to form a new surface soil no sickness either in cattle or sheep occurs, even on the high flattish land with a coarse pumice subsoil. Apparently, the fact that the soil is a sandy loam with over 5 per cent. of clay is largely respon-

sible for this immunity. In addition, little time has elapsed for leaching to occur; iron is present in considerable quantity, and, judging by the colour (bluish grey), is not yet greatly oxidized.

The road from Rotorua to Atiamuri passes through a large area of country the surface soil of which, generally of coarse texture, is derived from subaerially deposited pumice, as in the remainder of the district. This deposit varies in depth from 1 ft. to 4 ft., the substrata consisting of alluvial deposits varying from coarse water-worn gravel to well-sorted sands, silts, and clays of a compacted and fairly impervious nature. Excessive leaching of the topsoil seems thereby to have been prevented, and the run-off of rain-water and the formation of springs, streams, swamps, and seepage areas greatly increased. Thus, despite the presence of other factors favouring iron-starvation, the latter does not appear to have been found where farming on this area has been carried out.

Remedial Treatment for Iron-starvation.

Remedial treatment may be sought in three different directions: (1) By supplying iron to the animal direct; (2) by supplying iron to the pasture direct, either through the leaves or through the roots; (3) by sufficiently modifying any of the factors contributing to the present unavailability of the iron in the soil.

(1) Feeding of iron salts to the animal, particularly iron ammonium citrate as originally introduced by Mr. Aston, is meeting with very general success, but obviously has limitations. Its greatest usefulness is found in the case of dairy cows, where the supplying of a regular ration is a fairly simple operation.

(2) The supplying of iron to the pasture is being experimented with, ferrous sulphate being used both as a soil top-dressing and as a weak spray applied to the green growth. So long as the conditions which contribute to the unavailability of the natural iron in the soil remain unaltered, it seems unlikely that the application of soluble iron salts to the soil will be of more than temporary benefit, the application needing to be renewed at fairly frequent intervals.

(3) Modification of contributory factors: (*a*) The altitude of the surface soil above the permanent water table can scarcely be modified by human agency.

(*b*) Texture of the soil: Of the two possible ways in which this could be amended—namely, by increasing either the clay or the humus—the latter is alone likely to be practicable. As recommended by Aston (this *Journal* for August, 1924, p. 90) green manuring, of all avenues open to the farmer, appears to be the most immediately promising for diminishing the trouble. By this means a closer and less pervious structure is given to the soil, the store of material capable of reducing the insoluble ferric to the more soluble ferrous form of iron salts is added to, and the general fertility of the soil increased. Somewhat the same end is attained by the establishment of a close and well-compacted turf of approved pasture-plants; and it is probably for this reason that with ageing of the pasture iron-starvation generally diminishes, while reploughing and resowing is said frequently to produce a temporary return to a more

acute stage. Rolling, trampling by stock, or other means of consolidation also should be beneficial, both by decreasing the air space in the soil and by tending to restrict soakage and leaching.

(*c*) Neither the nature of the substrata, nor (*d*) the amount of rainfall, nor (*e*) the general nature of the topography are factors amenable to practical control.

(*f*) Building up of the store of iron in the soil should be aimed at, even though much of it may be rendered for the time-being practically unavailable. Especially is the use of basic slag (or, better still, of a slag-super mixture) or a mixture of iron sulphate with superphosphate likely to be beneficial, as the phosphate encourages root growth, and, by bringing the roots into close association with the iron, may tend towards a greater degree of absorption. Mr. Aston has recently recommended the trial of "ferrous superphosphate," a mixture of superphosphate, sulphate of iron (hydrated ferrous sulphate), and hydrated sulphate of lime (gypsum). This mixture contains 12 per cent. of iron sulphate (see Griffiths's "Treatise on Manures," 1892, p. 283, Whittaker's, London).

(*g*) The utilization of any areas of seepage, swamp, or river flat existing on "bush-sick" farms should be zealously aimed at, pasture grown under such conditions being usually rich in iron and an antidote to the sickness.

The writer desires to acknowledge the great assistance he has received from Professor C. A. Cotton, of Victoria University College, Wellington, the leading New Zealand authority on land forms, who accompanied him on a tour through the Rotorua and adjoining counties.

YARROW FOR SECONDARY BURNS ON HILL COUNTRY.

REFERRING to Mr. E. Bruce Levy's remarks in the March *Journal* (page 161) on the inclusion of yarrow in seed mixtures for secondary burns, Mr. L. M. Monckton, of Waipukurau, writes to the Editor as follows:—

"Some thirty years ago a property I knew very well was entirely swept by a very heavy second fire, which practically killed all the grass. Yarrow came up very thickly after the fire (2 oz. per acre of it having been sown with the mixture when the bush was fallen and burnt some years before). After the secondary fire the property was resown, but it was late and the grass-seed came badly. The place was heavily stocked (two breeding-ewes per acre), and they lived all the winter on practically yarrow. What is more, nearly all the lambs went to the works off their mothers. Needless to say, the country was good, being all limestone, and of course it had the advantage of the heavy dressing of ashes from the second fire."

Production of Butterfat.—For the first nine months of the present dairying season—August, 1926, to April, 1927, inclusive—the quantities of dairy-produce graded for export by the Dairy Division totalled 66,456 tons of butter and 70,517 tons of cheese. In terms of butterfat this represents a net increase of 9·11 per cent. in butterfat production as compared with the corresponding period for 1925–26, and an increase of 1·9 per cent. over the same months of the 1924–25 season, which latter now holds the record for a year's production. Given favourable weather conditions for the remainder of the present season, there is thus a good prospect of a new record being established this year.

PASTURE TOP-DRESSING EXPERIMENTS IN WELLINGTON AND SOUTHERN HAWKE'S BAY, SEASON 1926-27.

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DURING the autumn of 1926 the Department of Agriculture, in co-operation with certain farmers in the Wellington and southern Hawke's Bay districts, laid down a series of some twenty manurial top-dressing experiments, with the object of making comparisons between the most commonly used phosphatic fertilizers.

The experiments were so designed that superphosphate, basic superphosphate, basic slag, and Ephos phosphate were applied in adjacent strips, each 6 chains long by one width of the top-dressing machine. To ensure a reliable comparison of the manures, or, in other words, to ascertain the effect on many parts of the same field, the series of manurial strips was replicated six times. Each manure was applied at the rate of 3 cwt. per acre, accuracy being attained by tying a sheet beneath the machine and weighing the quantity sown in a measured distance. Every fifth plot was left untreated as a control, enabling many comparisons to be made between the effects of the various manures and the natural untreated condition of the paddock. Further, while each fertilizer was repeated six times, the scheme was so designed that each manure in turn adjoined one of the controls or untreated areas.

In addition to this arrangement, three strips of ground limestone, each 1 chain wide and applied at the rate of 1 ton per acre, were sown across the experiment at right angles to the manures, alternating with similar areas on which no lime was applied. By this arrangement the effect of each manure, with and without the addition of lime, was obtained; likewise, where these strips of lime cross the untreated areas or controls the effect of lime against no lime was indicated.

OBSERVATION PLOTS.

It was hoped by laying down a number of such experiments, scattered throughout the districts, that even under ordinary grazing conditions differences between the various treatments would be apparent to the eye, in which case field-days would be held to enable surrounding farmers to discuss the relative effects of the manures. In experiments of this nature, where stocking returns are not obtainable and green weights cannot be conveniently secured, the differences can be measured only by observation, and must be very distinct to justify definite statements.

In comparing the treatments the chief points noticed were the development of clovers and good grasses, the proportion of bare ground, and the general condition of the pasture. Under "condition" is included the relative quantity of seed-heads (an indication of grazing), the quantity of dead, trampled vegetation, and the general colour of the pasture, which should be typical of vigorous healthy young growth. Where field-days were held farmers were unanimous in their opinion of which treatment had produced the greatest improvement.

A very interesting development occurred on the plots sown on Mr. J. Gildea's farm at Maharahara. The pasture was three years old, and was rather lightly stocked with dairy cows. The remainder of the paddock, not occupied by the experiment, was top-dressed with slag about the same date as the experimental plots. During the spring there was a good growth over the whole field, but a remarkable feature stood out distinctly. This was a number of closely eaten strips about 8 ft. wide extending throughout the length of the experimental area—a condition not found anywhere else in the whole paddock, while bounding them the grass and clover, of apparently first-class quality, was from 8 in. to 9 in. high. Had these particular plots been kept continuously mown during the spring they could not have appeared more striking. The close-cropped condition was obviously not due to lack of vigour, as evidenced by the colour, &c., but to the voluntary heavy grazing of the stock. The plots so favoured by the stock were those to which superphosphate had been applied, and probably the preference shown may be attributed to the rapid action of the super in promoting early and vigorous spring growth. Thus as the vigorous growth continued the stock, finding the young pasture more succulent, would pay more attention to these particular areas. The basic-super plots also attracted particular attention from stock, but were grazed to a lesser extent than the super. It would not be surprising to find that the plots were grazed in proportion to the percentage of readily available phosphates in the different fertilizers applied. The slag, Ephos, and control plots, together with the remainder of the field, appeared to receive equal attention from the stock.

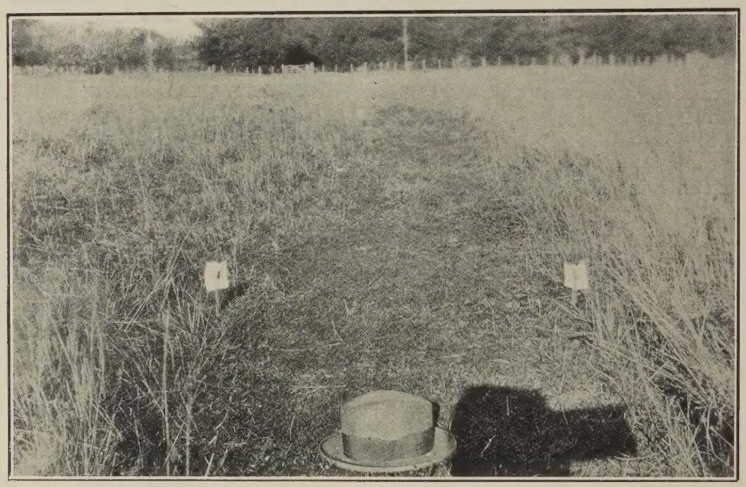

FIG. I. SHOWING CLOSE GRAZING OF SUPERPHOSPHATE-DRESSED PLOT ON MR. GILDEA'S FARM, MAHARAHARA.

The strip in centre is the super plot; on left is basic slag, and on right a control (unmanured) plot, both comparatively neglected by stock.

FIG. 2. ANOTHER SUPERPHOSPHATE PLOT (CENTRE), WITH CONTROL ON LEFT AND EPHOS ON RIGHT.

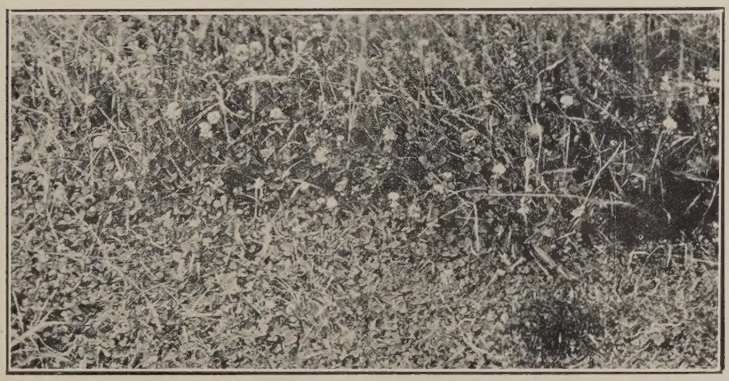

FIG. 3. NEAR VIEW EARLIER IN SEASON WHEN CLOVER WAS FLOURISHING.

Superphosphate in foreground, basic slag at back. Both plots containing abundant clover, but super well grazed.

These observations were confirmed in a similar test on Mr. Norman Inder's farm at Piripiri, Dannevirke, where the pasture had also been lightly stocked with dairy cows. Here also the basic-super plots had been eaten to a lesser extent than the super areas, while the remaining plots, although of apparently the same botanical composition, were neglected.

It should be clearly understood that the foregoing observations were only possible in those few instances where understocking permitted the

animals to discriminate. In all the other observation areas laid down, where the stocking did not permit surplus growth the various effects from manures which could be discerned by colour, condition, &c., gave similar impressions.

GREEN-WEIGHT EXPERIMENTS.

In addition to these observation plots experiments were laid out in three localities—Rongotea, Rangiotu, and Rangiwahia—on three very different types of soil. The areas selected were hay-paddocks, two of which had been cut fairly consistently for eight and twelve years respectively, and had never received any manurial treatment previously. The object of these experiments was to obtain definite figures of the effects of manures by recording the green weights from a given area of each plot. A "green weight" is taken within a few minutes of mowing and before any drying has occurred, while the crop is being cut for hay. When weights are to be compared they must necessarily represent the yield from equal areas, and, to ensure this, in each case the mowing-machine was driven down the centre of each plot, thus ensuring that all cuts were of even widths. Each swath was then measured into half-chain lengths and immediately weighed. A number of interested farmers were present in each case, and all were emphatic in their opinion that the methods adopted were as accurate and reliable as possible.

In the accompanying tables of results the last column gives an indication of the odds in favour of the increase due to the varying treatments being correct or statistically "significant." The odds refer only to the increase of the treatment over no treatment. Another examination of weights would be required to determine definitely the relative value of the manures, although in both Martin's and Parker's experiments superphosphate is distinctly in advance of any of the other manures. It must be realized that the odds are not based solely on the quantity of increase, but also on the natural variation which has occurred in the weights recorded. Thus it is seen that in Parker's weights 1 ton of lime per acre appears to have increased the yield by 8 cwt., but as the odds are "non-significant" this increase cannot definitely be attributed to lime.

COMMENTS ON TABULATED RESULTS.

From the tabulated results it will be seen that superphosphate has produced more growth than any other treatment. Slag, Ephos, and basic super yield so closely that there is not sufficient difference to distinguish between them without further statistical examination, although, beyond doubt, each has improved the yield of the untreated paddock. Only in one case (H. Bond, Rangiotu), on land which was waterlogged throughout the winter, is there any increase in yield which one is justified in attributing to the addition of lime. Although lime alone has decreased the yield, the addition of lime to superphosphate has almost doubled the gain produced by that manure alone. This may possibly be accounted for by the fact that the ground in question is of a somewhat peaty nature, and was very sodden in consequence of the extremely wet conditions prevailing in the Manawatu district last winter and late into the spring. Under these conditions there would

probably be an accumulation of soil-bases which would form insoluble compounds with a part of the phosphates. The addition of lime presumably releases the phosphate in a number of these compounds, and so makes more phosphates available for the plant. While the results recorded on these (Bond's) plots are quite reliable under the wet conditions prevailing last winter, they may probably be at variance with results securable in an average year. Slag and Ephos are slower-acting manures and act better where a fair percentage of soil-acidity is present. This is shown in the case of Ephos on Bond's plots, where, on a soil of a peaty nature, it produced an increase as large as that given by super. A difference is seen, however, where the Ephos plots had an addition of lime. Not only here, but in every case lime appears to have reduced the yield of Ephos. The failure of slag to show a significant increase on Bond's plots is very interesting, and justifies further investigation.

Table 1.—Results on Farm of H. Bond, Rangiotu.

Treatment.	Number of Plots paired.	Yield per Acre in Green Weight.	Difference in Favour of Treatment over no Treatment.	Percentage of Increase.	Difference Significant or Non-significant.*
		Manures only.			
		T. cwt. qr. lb.	T. cwt. qr. lb.		
No manure ..	13	6 17 1 16			
Super, 3 cwt. per acre	..	7 13 0 12	0 15 2 24	11·43	S.
No manure ..	15	6 18 0 11			
Slag, 3 cwt. ..	..	7 7 2 3	0 9 1 20	6·82	N.S.
No manure ..	14	6 4 3 2			
Basic super, 3 cwt.	..	6 15 3 5	0 11 0 3	8·84	S.
No manure ..	15	6 2 2 8			
Ephos, 3 cwt. ..	..	6 16 2 3	0 13 3 23	11·38	S.
No lime	12	6 10 1 5			
Lime, 1 ton ..	..	6 2 1 21	0 7 3 12†	6·09†	S.
		Manures and Lime.			
No manure . ..	14	6 6 3 7			
Super, 3 cwt., and lime, 1 ton per acre	..	7 12 1 22	1 5 2 15	20·21	S.
No manure ..	18	6 10 1 11			
Slag, 3 cwt., and lime, 1 ton	..	7 3 0 2	0 12 2 19	9·71	S.
No manure ..	17	6 8 1 9			
Basic super, 3 cwt., and lime, 1 ton	..	7 2 3 22	0 14 2 13	11·38	S.
No manure ..	18	6 2 3 3			
Ephos, 3 cwt., and lime, 1 ton	..	6 12 3 24	0 10 0 21	8·30	S.

* A difference is regarded as "significant" only when the chances are 30 to 1 or more in its favour as computed under the statistical method of examination. † Decrease.

Apart from Bond's results, which are from a soil recognized as differing considerably from the average, the results obtained are not unexpected, and, taken in conjunction with those of other experimenters, lead one to ask whether the manurial responses from normal average types of soil met with are as different as some farmers believe. The suggestion that the results will usually be in the same proportion whether the manure is applied to river-silts, loams, or average hill-country may have some foundation. Undoubtedly there are exceptional types as, for example, light sand country, peaty swamps, pumice lands, &c. which would not be regarded as average soils and which, quite naturally, might require special consideration.

From the record of Parker's and Martin's weights it will be noticed in each case that the increase due to super amounted to 2 tons per acre of green material. This increase occurred in both cases as a result

Table 2.—Results on Farm of J. Parker, Rongotea.

Treatment.	Number of Plots paired.	Yield per Acre in Green Weight.	Difference in favour of Treatment over no Treatment.	Percentage of Increase.	Difference Significant or Non-significant.
		Manures only.			
		T. cwt. qr. lb.	T. cwt. qr. lb.		
No manure ..	18	6 3 2 4			
Super, 3 cwt. per acre	..	8 6 0 5	2 2 2 1	34·41	S.
No manure ..	18	6 4 2 14			
Slag, 3 cwt. ..	..	7 10 0 27	1 5 2 13	20·55	S.
No manure ..	18	6 4 1 9			
Basic super, 3 cwt.	..	7 16 2 4	1 12 0 23	25·90	S.
No manure ..	18	6 3 0 26			
Ephos, 3 cwt. ..	..	7 10 1 21	1 7 0 23	22·08	S.
No lime	21	6 4 0 6			
Lime, 1 ton ..	..	6 12 2 4	0 8 1 26	6·83	N.S.
		Manures and Lime.			
No manure ..	18	6 3 2 4			
Super, 3 cwt., and lime, 1 ton per acre	..	8 9 0 4	2 5 2 0	36·83	S.
No manure ..	18	6 4 2 15			
Slag, 3 cwt., and lime, 1 ton	..	8 0 0 4	1 15 1 17	28·40	S.
No manure ..	18	6 4 1 21			
Basic super, 3 cwt., and lime, 1 ton	..	8 9 3 11	2 5 1 18	36·42	S.
No manure ..	18	6 3 0 26			
Ephos, 3 cwt., and lime, 1 ton	..	7 2 2 3	0 19 1 5	15·24	S.
No manure ..	7	6 18 1 14			
Cow-manure, 15 tons per acre (approx.)	..	8 10 3 4	1 12 1 18	23·42	S.

of closing these paddocks for a period of eleven and a half weeks; and the question arises, What would this increase mean to a dairy-farmer? As a number of farmers will rightly or wrongly consider that a 2-ton increase is beyond the capability of their own particular paddocks, we reckon on the conservative assumption that an increase of at least 25 cwt. (green weight) may be expected. Reliable data show that 1 ton of average good pasture may be expected to produce not less than 14 lb. of butterfat. (A. H. Cockayne, in this *Journal* for August, 1921.) At current prices the return from 3 cwt. of super applied is therefore 17½ lb. of butterfat at, say, 1s. 2d. per pound, or £1 0s. 5d.; and this for a period less than three months, leaving the remaining nine months as clear profit. If manure is applied at present prices—say, £5 10s. per ton on the farm—the cost of 3 cwt. per acre would be 16s. 6d., and even with butterfat at only 1s. 2d. per pound the outlay and more would be returned before January.

The next question that arises is, Does it pay to top-dress annually? In the absence of definite data the following theory is offered: Without

Table 3.—Results on Farm of M. Martin, Rangiwahia.

Treatment.	Number of Plots paired.	Yield per Acre in Green Weight.	Difference in Favour of Treatment over no Treatment.	Percentage of Increase.	Difference Significant or Non-significant.
		T. cwt. qr. lb.	T. cwt. qr. lb.		
Manures only.					
No manure ..	25	5 0 0 5			
Super, 3 cwt. per acre ..	..	7 0 1 14	2 0 1 9	40·31	S.
No manure ..	24	4 13 3 21			
Slag, 3 cwt. ..	..	6 3 1 17	1 9 1 24	31·36	S.
No manure ..	24	4 13 3 21			
Basic super, 3 cwt. ..	..	6 7 1 21	1 13 2 0	35·66	S.
No manure ..	24	5 3 2 18			
Ephos, 3 cwt. ..	..	6 13 2 8	1 9 3 18	28·85	S.
No lime	28	4 16 3 17			
Lime, 1 ton ..	..	5 2 1 6	0 1 5 17	5·57	N.S
Manures and Lime.					
No manure ..	35	4 18 1 16			
Super, 3 cwt., and lime, 1 ton per acre	..	6 10 3 22	1 12 2 6	33·08	S.
No manure ..	35	4 16 0 25			
Slag, 3 cwt., and lime, 1 ton	..	6 1 0 23	1 4 3 26	25·95	S.
No manure ..	36	5 3 1 5			
Basic super, 3 cwt., and lime, 1 ton	..	6 3 3 23	1 0 2 18	20·00	S.
No manure ..	36	5 5 2 22			
Ephos, 3 cwt., and lime, 1 ton	..	5 15 1 13	0 9 2 19	9·14	N.S

a further application of manure in the second season, and continuing on the same conservative basis, the residue of the previous application could safely be expected to give half the increased weight of the first year—namely, 12½ cwt. Now if, during the second year, a further 3 cwt. of super is applied, is it not reasonable to again expect an increase of 25 cwt.? This, with the increase from the residue of the previous year, would amount to 37½ cwt. due to annual top-dressing; or, in terms of butterfat at 1s. 2d. per pound, it gives a return of £1 10s. 6½d. for a further expenditure of 16s. 6d. These figures deal with a period of only three months, and though they are based on 62·5 per cent. of the actual increase recorded in the experiments, they show that manuring pays handsomely. No allowance has been made for the increased grazing which would be expected during the remaining nine months of the year.

So far the evidence furnished by the foregoing experiments is not at variance with the results obtained by other investigators, and appears to favour the use of the more readily available fertilizers. The farmers who so ably co-operated with the Department, realizing the value of such work, have voluntarily offered facilities for continuing the experiments on their respective farms, thus enabling further data to be accumulated next season.

FOOT-ROT IN SHEEP AND ITS TREATMENT.

T. A. Blake, M.R.C.V.S., Veterinarian, Auckland.

The cause of foot-rot in sheep is the toxin or poison secreted by certain micro-organisms which have gained entrance to the affected foot. The predisposing or contributory causes are: (1) An injury to the soft tissues between the claws, seen especially when the sheep are depastured on long rank grass, or on ploughed land where particles of grit may easily find their way into the inter-digital space and cause abrasion or injury, however slight, to the soft tissues in the cleft; (2) a weakening of the horny substance of the foot by excessive moisture, seen especially in wet seasons, at periods when heavy dews are prevalent, and on wet land.

The methods of treatment of foot-rot may be classed under two main headings—hand dressing and foot-bath treatment; but the essential operation common to both these methods is the proper and thorough trimming of the foot before any medicinal dressing is applied. Trimming of a foot consists in cutting away all overgrown horn, especially that part of the wall which becomes bent inwards over the sole, and in removing all loose or diseased horn, besides any dead or decaying tissue. A pair of cutters is useful in the quick trimming of the overgrown wall. The aim of the operator should be to allow the drainage of pus from the lesion, with as little removal of healthy tissue as possible, the cutting not being carried deep enough to allow the escape of much blood.

After the feet have been trimmed the application of an antiseptic and astringent dressing should be undertaken. When only small numbers of sheep have to be treated hand dressing is usually practised, and for this purpose there are several good drugs available whose successful action has been proved during many past years. Ointments are useful on account of their prolonged action, the one recommended

being made up as follows: Over a *slow* fire mix powdered bluestone, one part; lard, one part; and Stockholm tar, two parts. The foot should be dry for the proper application of an ointment. Other preparations in use are tincture of iodine, carbolic acid (one part to twenty of water), and sheep-dip. For severe cases butter of antimony may be applied with a feather or small brush, taking great care in its use because of its caustic properties. This is especially useful where fungoid growths resembling proud flesh are in evidence.

When large numbers have to be dealt with it is necessary to pick out the sheep badly affected, so that more constant attention may be given to them than to the flock generally. For the latter a foot-bath is recommended. This should be built of concrete or wood, either permanently with fixed rails or placed in position with hurdles to act as guides. It should be in the form of a trough 12 ft. long, 18 in. wide, and 6 in. high; or a portion of the yard may be concreted, with the edges of the concrete raised a few inches to hold the solution. This latter plan is a good one, in that sheep can be stood in the solution for a few minutes while the remainder of the animals are being prepared. A thin layer of wool may be laid on the floor of the trough to prevent splashing.

According to the strength and nature of the solution, the time of immersion should range from one to a few minutes allowing only one minute for poisonous baths, and, say, five minutes for the bluestone mixture. There is no need for more solution in the bath than will just cover the feet of the sheep. For poisonous baths it is necessary to provide a yard for drying, in order to prevent mortality from the ingestion of grass contaminated with the poisonous ingredients.

The bath solutions recommended are as follows:—

(1) Bluestone dissolved in water at the rate of 4 oz. to 1 gallon. Double this strength may be used on cases which need a greater caustic action. Bluestone is cheap, non-poisonous, fairly easily dissolved, and has been found quite efficacious.

(2) Arsenic dissolved in water in the following manner and proportions: Over a *slow* fire heat 1 lb. white arsenic, 1 lb. carbonate of soda, and 1 gallon water until the arsenic is dissolved. Add 5 gallons of water to make the mixture ready for use When using this solution sheep should be walked through and not stood in the bath. Arsenic is poisonous, so must be carefully handled, and the possibility of ingestion by stock or human beings avoided.

(3) The various sheep-dips and foot-rot cures on the market, made up according to directions, should also be quite successful.

Whatever particular medicament is used as a dressing, it must be borne in mind that drainage of the foot is necessary, and, with that object in view, careful and thorough trimming is essential. The frequency of any form of treatment must be decided by the proportion of animals affected and by the severity of the individual cases. Bad cases need attention every second or third day, while once a week is not too often for a walk through the bath when a flock is seriously affected.

Having regard to the causes of foot-rot it will be recognized that sheep should be put into the driest paddocks available, and especially into such paddocks as will provide an opportunity for the normal wear of the horny part of the foot. As in other diseases, prevention is better than cure.

COVERED SMUT OF BARLEY AND ITS CONTROL.

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

COVERED SMUT is one of the commonest and most destructive diseases of barley in New Zealand. This year in Marlborough twenty-three out of forty-nine crops, and in Canterbury fifty out of sixty-nine crops examined were infected, the loss varying from a few heads to a third of the crop. The disease is carried from one year to the next entirely on the seed; so that if seed free from infection is sown no smut will develop in the crop. Naturally, clean seed is rare, since, even from a clean crop, it is likely to be contaminated during threshing and cleaning. Therefore all seed should be disinfected before sowing. Any grower who neglects to disinfect his seed, however clean it appears to the eye, is almost sure to find smut in his crop. He may lose only a few heads, or, as in the case of the two lines of Plumage barley used in the experiments here detailed—which were sown as they came from the cleaning plant and without artificial infection—he may lose 30 to 40 per cent. of his crop and render the remainder quite unfit for malting purposes.

COVERED SMUT OF BARLEY.

[*Photo by H. Drake.*

METHODS OF CONTROL.

The use of formalin provides the most efficient practical method of seed-disinfection for the control of covered smut, using either the "steep" or the "sprinkle" method. If a suitable container is available—formalin does not attack metals, wood, or concrete—the steep method is preferable, and should be carried out as follows:—

Make up sufficient solution by mixing commercial formalin (as purchased) with water at the rate of 1 pint of formalin to 30 gallons. Measure the quantities accurately, and do not add a little more formalin "for luck." The sacks of seed barley—which should not be more than one-third full, and sewn rather than tied—are dipped under the solution for ten minutes, and the grain moved about within the sack several times while under. After ten minutes' immersion each sack is

hoisted out, allowed to drain back into the trough, and then spread out singly on the ground or floor to dry out. If the dipping is done overnight the seed will be dry enough to sow on the following day. The grain will have increased about 20 per cent. in size, and allowance must be made for this in adjusting the seeder. The same solution may be used throughout, filling up, when too low to cover the sacks, with fresh solution previously prepared in the same proportions. Do not empty the treated grain into other sacks unless these have been soaked in the solution.

If a suitable trough is not available the sprinkle method may be used. With this method the seed barley is emptied out in a heap on a tight floor, and the formalin solution—previously made up accurately in the proportion of 1 pint to 30 gallons—is sprinkled over it from the rose of a watering-can. The heap should be shovelled over at least three times while under the sprinkle, to ensure that every grain is thoroughly wetted by the solution. The heap is then covered overnight by sacks soaked in the solution, care being taken that there is good drainage away from the heap so that the bottom layers do not lie in a pool of the liquid.

Bluestone (copper sulphate) may be used instead of formalin, the procedure being the same, but using a solution strength of 1 lb. of bluestone to 10 gallons water. Bluestone, however, does not control covered smut so effectively as does formalin, and is more apt to lower the vitality of the seed.

The hot-water method, while invaluable in cleaning up a line for stud-seed purposes, is not adapted to general farm use.

EXPERIMENTS ON CONTROL.

Three lines of naturally infected barley were used in the 1926–27 experiments—two being lines of Plumage grown on different farms in Canterbury, and the third being a line of Cape grown at the Central Development Farm, Weraroa.* All were sown from 9th to 12th September, 1926; the first, or germination, count was made on 19th to 21st October, and the whole were finally pulled and counted from 1st to 4th February, 1927. A spell of heavy rain, followed by drying winds after sowing, caked the ground, so that the plants had difficulty in pushing through, and as a result germination counts were irregular, with a high probable error.

Summary of Results presented in Table 1.

(1) Copper carbonate dust, Semesan dust and steep, Uspulun steep, and Clarke's Wheat Protector failed to disinfect completely.

(2) Bluestone 1 per cent. and 2 per cent. controlled covered smut in the Cape and Odger's Plumage, but failed to do so in Beck's Plumage. Germination was seriously lowered by the 2-per-cent. solution with Odger's Plumage only.

(3) Formalin at 1–240 (1 pint to 30 gallons), 1–320 (1 to 40), and 1–480 (1 to 60) gave complete disinfection, with the exception of one plant of Beck's Plumage. Germination and total heads were higher in all three than in the untreated controls.

* Samples kindly supplied by Mr. C. H. Hewlett, Manager, Canterbury Seed Co., and Mr. J. F. Shepherd, Manager, Central Development Farm, Weraroa.

Table 1. Experiments on Covered Smut of Barley at Ashburton Experimental Farm, Season 1926-27.

Treatment.	Beck's Plumage.										Odger's Plumage.										Cape.									
	Percentage Germination.				Plants.			Heads.			Percentage Germination.				Plants.			Heads.			Percentage Germination.				Plants.			Heads.		
	In Field.										In Field.										In Field.									
	In Laboratory.	First Count. %	First Count. PE ±	Mature Plants.	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	In Laboratory.	First Count. %	First Count. PE ±	Mature Plants.	Total.	Smutted.	Percentage smutted.	Total	Smutted.	Percentage smutted.	In Laboratory.	First Count. %	First Count. PE ±	Mature Plants.	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.
Control	96·5	69·0	1·58	65·2	261	94	36·0	1,376	408	29·6	97·5	53·5	2·10	52·2	209	102	48·8	1,132	188	43·1	98·0	80·0	1·88	71·2	285	30	10·5	1,029	88	8·5
Copper carbonate, 2 oz.	98·5	77·2	1·49	73·5	294	11	3·7	1,212	23	1·9	95·5	67·0	1·69	64·7	259	19	7·0	1,305	89	6·8	96·0	91·2	0·87	78·0	312	2	0·6	954	2	0·2
Semesan dust, 2 oz.	95·5	78·0	1·65	75·2	301	11	3·6	1,177	44	3·7	97·5	73·7	2·07	73·7	295	75	25·4	1,328	300	22·5	99·0	88·0	1·28	80·7	323	2	0·6	1,009	8	0·8
Semesan steep, 0·25 per cent., 1 hr.	96·0	81·2	1·36	79·5	318	13	4·1	1,159	45	3·8	98·0	71·7	1·09	70·0	280	14	5·0	1,142	47	4·1	97·5	87·2	1·49	80·2	321	2	0·6	996	7	0·7
Uspulun, 0·25 per cent., 1 hr. ..	96·0	78·5	1·88	74·2	297	5	1·7	1,119	18	1·6	97·0	69·7	1·40	69·2	277	14	5·0	1,076	50	4·6	96·0	87·5	0·93	81·5	326	0	0·0	1,084	0	0·0
Clarke's Protector	91·5	75·2	1·45	70·7	283	8	2·8	1,104	32	2·7	82·0	42·2	2·07	44·0	176	1	0·6	845	7	0·8	94·5	84·5	1·58	76·5	306	1	0·3	1,051	4	0·4
Control	93·5	66·5	2·29	65·0	260	82	31·5	1,218	282	23·1	98·0	49·0	1·64	48·5	194	95	48·9	1,120	495	44·2	..	81·7	1·59	75·7	303	19	6·2	1,146	55	4·8
Bluestone, 1 per cent.	92·0	71·2	1·98	65·7	263	10	3·7	1,217	31	2·5	84·5	50·5	1·75	50·0	200	0	0·0	1,012	0	0·0	94·5	85·5	1·39	79·0	316	0	0·0	1,036	0	0·0
Bluestone, 2 per cent.	82·0	64·2	1·82	63·5	254	2	0·8	1,185	6	0·5	67·5	25·5	1·28	28·5	114	0	0·0	762	0	0·0	78·0	76·2	1·42	74·2	297	0	0·0	1,079	0	0·0
Formalin, 1–240	90·5	80·0	1·69	76·2	305	1	0·3	1,385	2	0·1	92·0	53·7	1·34	52·5	210	0	0·0	1,354	0	0·0	87·0	80·2	1·05	77·0	308	0	0·0	1,139	0	0·0
Formalin, 1–320	81·0	68·7	1·34	64·7	259	0	0·0	1,185	0	0·0	96·0	53·7	2·29	51·5	206	0	0·0	1,264	0	0·0	92·5	79·2	1·32	75·5	302	0	0·0	1,227	0	0·0
Formalin, 1–480	96·0	79·7	1·51	76·0	304	0	0·0	1,218	0	0·0	97·5	54·7	1·92	56·7	227	0	0·0	1,305	0	0·0	94·0	82·2	0·91	76·7	307	0	0·0	1,145	0	0·0
Control	98·5	79·2	2·13	76·5	306	62	20·3	1,200	214	17·8	98·0	59·0	2·25	58·5	234	103	44·0	1,214	483	39·7	..	74·5	1·33	71·0	284	34	12·0	1,128	124	11·0
Hot Water.																														
6 hr. at 60°, 5 min. at 121° ..	96·5	69·0	1·05	66·7	207	1	0·4	1,106	3	0·3	90·0	71·2	1·57	63·7	255	0	0·0	1,084	0	0·0	94·5	84·2	1·49	80·7	323	1	0·3	1,152	2	0·2
6 hr. at 60°, 5 min. at 123° ..	96·5	72·5	1·60	71·0	284	1	0·3	1,146	5	0·4	94·5	60·0	1·94	62·5	250	1	0·4	1,264	2	0·2	94·0	81·7	1·63	83·0	332	0	0·0	1,105	0	0·0
6 hr. at 60°, 5 min. at 125° ..	95·5	70·0	2·55	65·5	262	1	0·4	1,167	1	0·1	95·0	51·5	1·90	49·7	199	0	0·0	1,155	0	0·0	90·5	86·2	0·76	78·5	314	0	0·0	1,005	0	0·0

| | | |

(4) The hot-water method—presoaking for six hours at 60° and 80° F., followed by a dip of five minutes at 121° to 129° F., presoaking for six hours at 60° followed by a dip of ten minutes at 119° to 127°, and a dip without presoak of ten minutes at 125° to 133° —gave complete disinfection (excepting one plant at 121° for five minutes) with Cape and Odger's Plumage ; but with Beck's Plumage, again, certain seeds seemed particularly resistant to disinfection. No advantage was apparent in using a presoak temperature of 80° rather than 60°, and, within the limits of the times and temperatures used, no material drop was apparent in germination or number of heads as compared with controls.

PASPALUM-SEED PRODUCTION IN NEW SOUTH WALES.

Reporting on a visit to New South Wales in December last, Mr. T. H. Patterson, Instructor in Agriculture, Auckland, refers as follows to the paspalum-seed industry in the North Coast district, where most of the commercial production is centred :—

"Mr. William Seccombe, of Coff's Harbour, with whose name paspalum-grass is so closely associated, showed me over the country around the Nambucca River, near Mackville, and thence to the valley of the Bellingen and the uplands adjoining that river ; from there we travelled to Bondville and on to Coff's Harbour. The slate and schist formation of the Mackville hill-country, with its soils of fair quality, is of special interest to New Zealand, because from that district over 50 per cent. of the paspalum-seed imported into the Dominion is harvested. The seed set by the grass yields a heavy shotty sample which germinates well, some of the best giving 70 per cent. and a little over in tests. Compared with seed from the alluvial areas of the Clarence, Richmond, and Tweed Rivers, and from the rich volcanic country near Lismore, it is much better if we judge by our present standards. About 100 tons of seed is sent annually to New Zealand.

"The best seed is saved from pastures which have been grazed down hard until about the end of December or, alternatively, mown to effect the same result. Then the pastures are shut up, as growth at that season of the year is rapid, and seed is set heavily and evenly. About 3 cwt. to 4 cwt. per acre is the usual yield per season.

"The following method is practised for taking 'hand-shaken' seed : A dish is suspended in front of the body of the harvester about level with the hips, and both hands are employed to draw in all heads, rub off, and drop into the dish the seed which is ripe. Paspalum-seed ripens unevenly, and therefore areas with heavy crops are gone over four to five times between February and April. The ripe seed is easily rubbed off by drawing the closed hand over a bunch of heads. A man will gather up to 100 lb. of seed per day, and some few do 200 lb. The best samples weigh about 22 lb. per bushel.

"At the time of my visit the district had been suffering from a prolonged drought. The rains started on the day of my arrival, and I have learned since that copious falls continued for over a month. These conditions should make this season's seed, though a little late, of excellent quality—as far as weight indicates quality."

INTERNATIONAL HORTICULTURAL CONGRESS, 1927.

It has been arranged to hold the next International Horticultural Congress at Vienna from 20th to 25th September next. The management will be in the hands of the Horticultural Society of Austria, whose centenary celebrations also take place this year, coinciding with the Congress. The last international congress of horticulture was held at Amsterdam in 1923, and the secretary of the permanent organization is Professor J. M. Sirks, Wageningen, Holland.

THE OTARI OPEN-AIR NATIVE-PLANT MUSEUM.

J. G. MACKENZIE, Director of Parks and Reserves, Wellington, and L. COCKAYNE, Honorary Botanist, New Zealand Institute of Horticulture.

Introduction.

WHEN, some eighty-seven years ago, the City of Wellington was founded most of the country in its immediate vicinity was clothed with noble forest. The pressing demand for timber and firewood, as also for farm lands, led by degrees to the destruction of nearly all this primitive tree-community, so that at the present time only a few isolated portions remain, for the most part greatly altered in structure, though some bear more or less their primitive stamp.

The best-known of these forest-remnants is that generally designated "Wilton's Bush." This, up till October, 1907, was the property of Maoris, but on that date the Government purchased the land from its Native owners, the Wellington City Council contributing £500 of the purchase-money. The area was forthwith proclaimed a scenic reserve, to be administered by a Board of seven members, of whom the Commissioner of Crown Lands for the Wellington District was to be chairman, and the chairman of the Reserves Committee of the Wellington City Council a member *ex officio*. But the Board could do little in the way of improving the reserve (making paths, fencing, &c.) through lack of funds; so in 1916 it passed a unanimous resolution requesting the Government to vest the reserve in the Wellington City Council. This position the Council would not accept unless the reserve became the property of the city. Finally, after negotiations had proceeded for some time, the reserve was handed over to the City Council in 1918 on their paying a further £700 for the property. Thus for the past nine years the reserve has been cared for by the Council, paths have been made, fences erected, the stream bridged, grazing within the precincts of the reserve forbidden, and the forest given a chance to slowly regenerate.

During the last two or three years more particularly—though really the need has been recognized for a long time—a strong feeling has arisen among those interested in the indigenous plants—no mean number of the public—that as complete a collection of such plants as possible should be established within easy reach of the centre of the city, where they could be enjoyed by the public and afford also material for study. This important matter was discussed at various times by the Council of the New Zealand Institute of Horticulture, but no definite steps were taken towards the desirable end. Eventually the City's Director of Parks and Reserves suggested in the daily Press that Wilton's Bush would be suitable for the purpose, and at some length he explained its value. This stimulus was exactly what the Institute of Horticulture required, and a deputation from that body, headed by its president, Mr. F. J. Nathan, waited on the Reserves Committee of the City Council and urged that the idea of the Director of Parks be adopted, pointing out at the same time what such meant to Wellington—and, indeed, to New Zealand. The Committee were most sympathetic, and promised to further the desirable project.

FIG. 1.—PORTION OF THE ORIGINAL FOREST STILL ALMOST VIRGIN.

In centre the rewarewa (*Knightia excelsa*).

[*Photo by H. Drake.*

A few days later the Honorary Botanist of the Institute of Horticulture, acting on behalf of the Institute and with the approval of the Director of Parks, drew up a full report on the subject, which was submitted to the Reserves Committee and accepted by them in its entirety. This report appeared in full in all the Wellington daily papers; and it is the ideas embodied therein, and their explanation, which is the main motive of this article. In other words, we seek to put on permanent record the history of this important movement, which, as will be seen, is truly a national movement, also the plans for carrying it out as endorsed by the City Council and the Institute of Horticulture. Further, we may explain that the scheme has been the subject of various eulogistic articles in Great Britain, which have appeared in such authoritative publications as *Nature*, *The Garden*, *The Gardeners' Chronicle*, and *The Kew Bulletin*. Also, much help has been promised spontaneously by lovers of New Zealand plants in various parts of the Dominion.

As a preliminary to the great work in hand, His Worship the Mayor of Wellington, Mr. C. J. B. Norwood, arranged for an official opening of the Museum and invited the citizens and others to be present. Notwithstanding most inclement weather, there was a large gathering, including the Hon. J. Hawken, Minister of Agriculture, and the Hon. R. A. Wright, Minister of Education. Memorial trees (kauris, rimus, totaras, &c.) were planted by the Mayor and Mayoress, the Ministers of the Crown and their wives, and others. Interesting speeches were delivered, and the reserve itself was explored and its beauty admired; in short, a most important public movement was fairly launched, and the career began of the Otari Open-air Native-plant Museum—Wilton's Bush no longer.

The area occupied by the Museum is about 143 acres, perhaps one-half of which is occupied by forest, some of which is practically virgin (Fig. 1). Much of the area consists of fairly steep slopes, but there are many level places of considerable size (Fig. 2), and there is every variety of aspect—a most important feature. The lowest part consists of a valley through which flows the Kaiwharawhara Stream (Fig. 3), which is crossed by a bridge (Fig. 4) leading by a natural pergola (Fig. 5) into the heart of the reserve. The unforested portion (Fig. 2) is of special moment in regard to the scheme now to be outlined.

Scheme for dealing with the Reserve.

The scheme adopted (but of course subject to minor modifications) is fourfold. It is not designed for immediate application as a whole—that would be impossible, even if advisable—but it will take many years. Briefly, this fourfold treatment resolves itself into the following distinct subjects: (1) The flora, including both the systematic and biological sides; (2) the vegetation; (3) horticulture; (4) restoration of the forest. We deal with them in that sequence.

THE FLORA.

In regard to the flora of New Zealand, it is intended to introduce into the reserve as complete a collection as is possible of the species of flowering-plants and ferns to be found in the New Zealand botanical

region. These number about eighteen hundred, and rather more than three-fourths are found only in New Zealand; the remaining one-fourth also occur as wild plants in other countries, a large majority being Australian. It may be explained that the flowering-plants comprise the trees, shrubs, semi-woody plants, and annuals and herbaceous perennials.

The species will be arranged as far as practicable according to their families. We say "as far as practicable" advisedly, since in many cases certain species, so closely related to others that they belong to the same genus, cannot live under the same conditions as their fellows and must be grown under a different environment. For example, the pigmy-pine (*Dacrydium laxifolium*) of mountain moorland cannot be grown side by side with the giant rimu (*Dacrydium cupressinum*)—

FIG. 2. ONE OF THE FLAT PORTIONS OF THE AREA, SUITABLE FOR PART OF THE SYSTEMATIC COLLECTION OF THE FLORA.

In the upper part of the view is seen damaged forest.

[*Photo by H. Drake.*

a forest-tree; nor can the lovely purple-flowered shrubby daisy of the Chatham Islands (*Olearia semidentata*)—a glorified Michaelmas daisy—be cultivated alongside its easily grown relatives of the subalpine scrubs. In short, botanical classification must not stand in the way of expediency, however much the herbarium botanist may look askance.

As well as the species, the hybrids between such will be cultivated, and their presence in cultivation will be of the greatest moment for the plant-classifier and the student of evolution. The number of such groups of hybrids in the New Zealand flora—usually great swarms of different-looking individuals—is probably considerably more than two-hundred and fifty, most of which have only been known for the last two or three years. Of such one of the writers (L. C.) has dozens in his own garden waiting for their place in the Otari Museum.

FIG. 3. THE KAIWHARAWHARA STREAM AS SEEN FROM THE BRIDGE NEAR THE LOWER ENTRANCE TO THE OPEN-AIR MUSEUM.

FIG. 4. THE FOOTBRIDGE OVER THE KAIWHARAWHARA AT THE LOWER ENTRANCE TO THE AREA.

To right and above greatly modified forest consisting largely of rangiora (*Brachyglottis repanda*).

[*Photos by H. Drake.*

FIG. 5. THE NATURAL PERGOLA LEADING INTO THE CENTRE OF THE AREA.
[*Photo by H. Drake.*

Each species in this systematic collection will be labelled accurately (the best botanical advice being always procurable), and in addition to its name will be appended its distribution in New Zealand and its habitat (the kind of place it naturally grows in—forest, swamp, dune, rock, &c.). Thus, when complete, almost the whole New Zealand flora will be seen at a glance, as it were, and the seasonal changes and other biological matters concerning each species can be observed.

It should go without saying that to have ready access to such an accurately labelled living flora will be of inestimable value for teachers and pupils, for nature-lovers, for professional botanists, as also for horticulture, agriculture, and forestry.

Besides being classified according to their relationships, plants can be grouped according to their forms, such being the outward expression of their relation to the places where they grow. Such forms are called "life-forms"—the forms, that is, upon the possession of which their very existence depends. In this regard New Zealand plants have much to tell, some of which is specially characteristic of the region. Collections of life-forms will be an interesting feature of the museum. Indeed, much of moment is there already. Thus, the climbing or liane form is greatly in evidence (Fig. 6); the possession of a long-persisting juvenile form distinct from that of the adult, as in the milk-tree (*Paratrophis microphylla*) and the mighty matai (*Podocarpus spicatus*) (Fig. 7); or the tussock form of many grasses, sedges, and even of the New Zealand flax (*Phormium tenax*).

THE VEGETATION.

More important than a classified living flora, and *something not yet attempted in any garden in the world*—and this is what makes the scheme unique—are to be representations of portions of the primitive vegetation of New Zealand. It must be clearly understood that the flora and the vegetation of a country are two quite different things. That is, the *flora* is concerned with the species merely as species, but *vegetation* with the combinations of species as they grow side by side, such combinations taken all together making the plant-covering of the land. Thus the flora of a region can be readily illustrated by dried plants in a herbarium, but the vegetation can be seen only in nature, or it can be represented by drawings or by photographs.

In nature plants do not grow haphazard, but they form well-defined communities, each more or less distinct from any other. So there are large communities, such as grassland, forest, shrubland, the plant-covering of boggy ground, of sand-dunes, and so on, and each of these may be subdivided into different smaller communities. Take forest, for instance: There is coastal forest with the karaka (*Corynocarpus laevigata*) dominant, or kauri (*Agathis australis*) forest, or southern-beech (*Nothofagus*) forest, or tawa (*Beilschmiedia tawa*) forest, to cite a few kinds. It is of such natural, virgin communities that artificial, accurate representations are to be attempted in the open-air museum. Thus it is hoped to be able to make a small piece of kauri forest and patches of other types of forest—for example, that of lowland Chatham Island. The subalpine scrubs of the high mountains, the manuka thickets of northern Auckland, the *Hebe* (koromiko) communities of

FIG. 6. THE LIANES—PASSION-VINE (TETRAPATHAEA TETRANDRA) AND BUSH-LAWYER (RUBUS AUSTRALIS).

[Photo by H. Drake.

FIG. 7. ON RIGHT, JUVENILE MILK-TREE (PARATROPHIS MICROPHYLLA); ON LEFT, JUVENILE MATAI (PODOCARPUS SPICATUS).

[*Photo by H. Drake.*

Canterbury, the cliff vegetation of Marlborough (a cliff awaits its new garb) are a few communities among many others which may probably be easily imitated and successfully established.

In the Motherland, and indeed in Europe generally, to reproduce the virgin vegetation is impossible in the majority of cases, since there are no longer living examples of such communities. But in our land, though the face of nature is day by day being changed out of all recognition, fortunately most of the plant-communities can still be seen in their virgin state, but usually far from the beaten track. Moreover, many have been so described that models are available for the gardener, aided by the botanist, to copy. Thus by degrees primitive New Zealand, as it was before the white man, or possibly the Maori, came on the scene, may in time be brought back again and have its home in an actual city.

HORTICULTURE.

This part of the scheme is also of a distinctly novel nature. The idea is to illustrate what use can be made of New Zealand plants in horticulture. Many wish, nay long, to grow the plants of their native or adopted land, but they know neither which to grow nor how to grow them. Thus, there can be readily established groves (not isolated plants) of trees celebrated for beauty of flower or elegance of form- for example, pohutukawas (*Metrosideros tomentosa*), kowhais (species of *Edwardsia*), lacebarks (species of *Hoheria*), the mountain-ribbonwoods (*Hoheria glabrata, H. Lyallii*), and cabbage-trees (*Cordyline australis*). Hedges of various species will be planted illustrating their relative value for the purposes of low or tall hedges and shelter-belts. Small gardens of native plants will be made in order to show what can be done with such by those with limited garden space.

An extremely important feature of this horticultural series will be a real alpine garden. Such can readily be formed on the banks of the stream (Fig. 8), and, judging from our experience in the cultivation near Wellington of New Zealand high-mountain species, the place selected should be an ideal spot. We feel certain that most of the mountain-daisies (species of *Celmisia*), the ourisias (species of *Ourisia*), and some of the large buttercups (species of *Ranunculus*) will grow admirably. Indeed, we are sanguine enough to believe that the famous mountain-lily (*Ranunculus Lyallii*) may become well established. This alpine garden will be one of the first pieces of work to be put in hand.

RESTORATION OF THE ORIGINAL FOREST.

Finally comes the question of how to deal with what remains of the "forest primeval." Here one essential point stands out clearly: this is that (with one proviso) no plant should be planted in the forest which was not originally in a similar plant-community of the neighbourhood. In certain places the forest is still intact (Fig. 1); there it must religiously be left alone. But in many places it is greatly altered from what it was originally (Fig. 9). Certainly nature is repairing the damage, but her methods are rarely rapid, nor would the new forest she is creating match her original handiwork. Man can do the work more rapidly, and, armed with scientific knowledge, can place in the forest, each in its proper situation, those species lacking or those not in sufficient numbers. Dozens of nikau-palms (*Rhopalostylis sapida*) will have to be

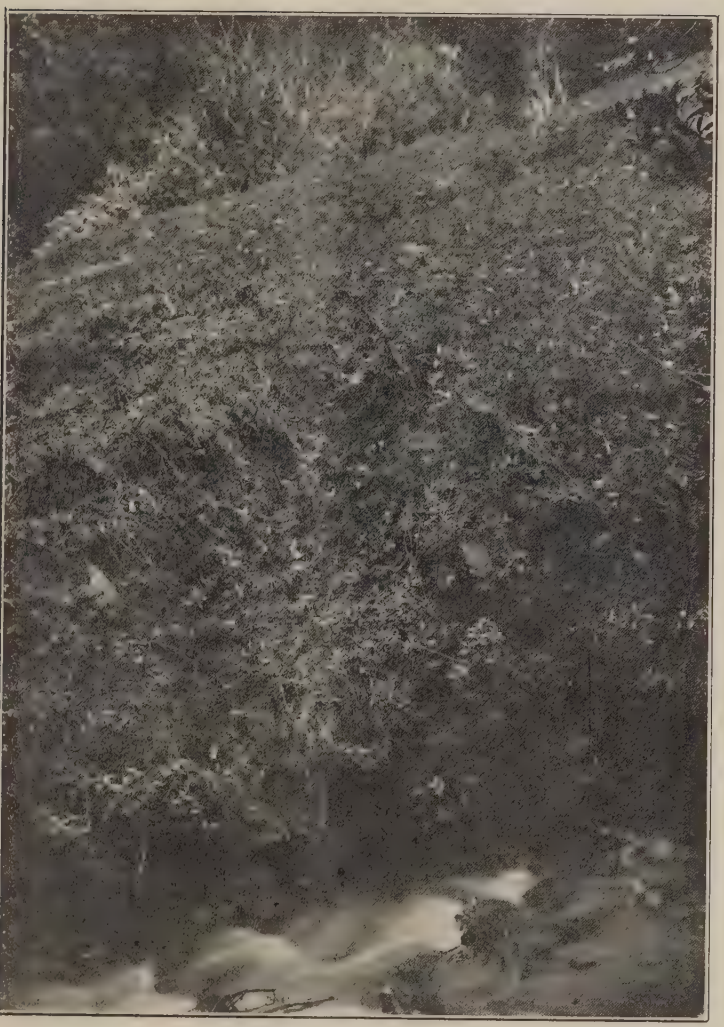

FIG. 8. PART OF THE SITE OF THE PROPOSED ALPINE GARDEN.

[*Photo by H. Drake.*

introduced; so, too, with the podocarps and other tall forest-trees; also the number of tree-ferns is insufficient, and the amount of rangiora (*Brachyglottis repanda*) too great. But a detailed survey of the forest is needed before rules for its restoration can be drawn up.

A proviso was attached to our statement in regard to planting nothing which was not originally in the forest. An attempt will be made to grow all the ferns of New Zealand (about one hundred and forty). Most will not grow in the open; they must have shelter and shade within the forest. Therefore a gully will be set apart for the fern collection; and there is one well suited for this purpose, easy of access, and in proximity to the site of the alpine garden. Here the

FIG. 9. FOREST MUCH DAMAGED AND MODIFIED, AWAITING RESTORATION.
[*Photo by H. Drake.*

planting can be begun without delay. Nor is such use of the one gully hostile to our motto, "Bring back the forest to its original composition and status, but change it not at all."

Summary.

In this article is told how Wilton's Bush, or the Otari Native-plant Museum, came into the hands of the Government, which constituted it a scenic reserve, and how, later, it was acquired by the Wellington City Council, partly by purchase. Further, it is explained how the purpose of the reserve was altered—largely through the action of the New Zealand Institute of Horticulture—and how it has been constituted an "open-air native-plant museum" where nothing is to be grown save the indigenous plants of the New Zealand region.

The plan upon which the museum is to be arranged—a plan approved by the City Council—is explained at some length. Briefly, it consists of a fourfold scheme, including (1) a collection of all the New Zealand species which can be grown; (2) examples, to be artificially made, of various important features of the primeval vegetation of New Zealand—this a unique undertaking; (3) the use of indigenous plants for horticultural purposes to be illustrated in various ways for the information of those desirous of using such plants in their gardens; and (4) the restoration of the present forest to what it was originally.

This plan in its entirety is the first to be formulated in any part of the world. It is full of possibilities for the good of the people. It is not for Wellington only but for the Dominion as a whole. Indeed, as the flora and vegetation of New Zealand are considered of special interest the world over, the influence of the Otari Open-air Native-plant Museum will be world-wide.

SELLING POULTRY BY WEIGHT.

F. C. BROWN, Chief Poultry Instructor, Wellington.

THE system of selling table cockerels by weight is now being freely adopted by many producers who cater for the Wellington market. At the present time poulterers and others interested in the table-poultry trade are giving 1s. 3d. per pound net for live birds scaling 3 lb. or over and in good marketable condition. Both buyers and sellers appear to welcome the change from the crude method of selling by the pair. Although this is the case, circumstances sometimes arise under the new system which bring about dissatisfaction. This is usually due to failure on the part of the producers to realize the unavoidable loss in weight which takes place during the transit of live birds from farm to market, especially when a lengthy railway journey is involved. On being dispatched from the farm the birds probably have their crop and intestines full, with the result that they do not weigh as well on arrival at the market or the purchaser's premises. Thus a good allowance must be made for the reduction.

An experiment designed to ascertain as closely as possible the loss in weight likely to take place with crated cockerels over a period of time was recently carried out at the Wallaceville Poultry Station. Sixty cockerels of the White Leghorn and Minorca breeds were used for the experiment. At 1 p.m. the birds were provided with their ordinary midday meal (mash), and at 2 p.m. they were placed in three market crates and weighed. They were again weighed at 9 a.m. on the following morning, and then dispatched to market. They reached the purchaser's premises at 4 p.m., or twenty-six hours after being first weighed, and were then again weighed.

The following table shows the results of the three weighings, and the loss of weight which took place during the first nineteen hours and twenty-six hours respectively after crating. It may be mentioned that while the experiment was being conducted climatic conditions were cool. Had the weather been warm there would

probably have been a greater reduction in weight. Further experiments on similar lines will be conducted at the Wallaceville Station in due course, in order to obtain wider data.

Crate No.	Number of Cockerels.	First Weighing.	Second Weighing.	Reduction in Weight.	Third Weighing.	Reduction in Weight.	Loss per Crate.
		lb.	lb.	lb.	lb.	lb.	lb.
1	20	102	97	5	95½	1½	6½
2	15	61	59	2	57	2	4
3	25	95	90	5	88	2	7

Aggregate loss, 17½ lb.

The most important point to note in connection with the present experiment was the average loss per bird of nearly 4½ oz. during twenty-six hours, or a total of 17½ lb. on the line of sixty, which in money value, at 1s. 3d. per pound, would represent £1 1s. 10½d. It will thus be seen how easily dissatisfaction may be brought about between buyer and seller.

Apart, however, from the loss of weight which takes place during transit, there are other matters that must be taken into account by the producer if selling by weight is to be as satisfactory to both parties as it should be. Reference is now made to the half-starved condition in which many producers send their cockerels to market. Such birds may scale more than the minimum weight of 3 lb. demanded, but if they are but mere frames they are not favoured by the high-class poulterer, to whom one properly fattened bird is worth more than two unfattened.

Another common mistake made by producers is to retain their cockerels till they have passed the prime chicken stage of, say, about five months old, and until they develop a sharp spur. Such birds are known to the trade as "stags," and are usually of little more value to the poulterer than an old hen.

Selling by weight should undoubtedly commend itself to the producer, as thereby he is not only encouraged to prime his birds to the best advantage, but is also in a better position to figure out the return he will receive. Any extension of the system in the Dominion will undoubtedly encourage the production of better table-poultry. The system, however, will never be placed on a really sound footing until the average producer realizes better than he does now the quality of stock demanded for the high-class trade.

The buyer as well as the producer has his part to fulfil. In the first place, he should see that all birds sent to him are carefully weighed and payment made accordingly. He should also see that there is no undue delay in collecting birds from railway-stations, &c., and having them weighed at the earliest possible moment, especially when consigned from a distance. A case in point recently came under my notice, when a line of cockerels forwarded to be sold by weight were not collected from the railway-station nor weighted for twenty-four hours after their arrival. Obviously a considerable reduction in weight took place, while, naturally, the returns did not come up to the owner's expectations.

SUBTROPICAL-FRUIT CULTURE.

ACHIEVEMENT AND POSSIBILITIES IN THE AUCKLAND DISTRICT.

Address by W. H. RICE, Orchard Instructor, at the Annual Conference of the New Zealand Association of Nurserymen, Auckland, January, 1927.

THE coastal regions of North Auckland, the Auckland Isthmus, and the East Coast of the Auckland Land District embrace a large area of land which is suitable for the cultivation of subtropical or semi-subtropical fruits. The range of subject in this paper is restricted to those species which will endure light frosts periodically, as it is exceptional to find a location that can be depended upon as permanently free from frost. In areas subject to regular frosts many of the more tender plants cannot be grown, so that the remainder of the Dominion is available as a home market for the produce.

In areas geographically situated as North Auckland frosts usually travel in south-western currents, which are deflected by hills and encouraged by large open spaces or continuous valleys. The gentle northerly slopes of a ridge will usually be found frost-free or most nearly so, except in such places where side deflections of air-currents are caused by foothills which divert the wind. However ideal the natural lay of the land, there are very few places which are not improved by growing a good south-westerly and easterly shelter-belt of sufficient density to prevent more than a gentle movement of air through the plantation. An easterly shelter is more necessary for the subtropical class of fruits than the harder temperate ones. Generally they are of a much softer luxuriant growth, easily damaged by the high winds which are frequently experienced from the east; and, further, some protection from the early sun is advisable in case of a light frost, so as to prolong thawing and thus minimize damage.

CITRUS-FRUITS.

The testing and establishment of subtropical fruits has been undertaken since the earlier settlement of the North, the citrus family having proved the most adaptable and profitable. Lemons and oranges were among the early exotics planted in this district, and history shows that they have succeeded or declined according to the amount of attention given to their culture. As introduced plants they have never been quite at home naturally, but they have responded to culture admirably. There are no fruit-trees grown here which decline so rapidly when care and attention are withheld, and this no doubt accounts for the fact that very few of the earlier plantations are in existence to-day. On the other hand, the response to proper culture is so good that the citrus industry has made rapid strides towards economic importance. Lemons in particular may be grown to near perfection.

Lemons.

Some twenty years ago Auckland-grown lemons were exhibited and highly praised in Australia, and this year, despite the large quantities of citrus fruits grown in the Commonwealth, New Zealand

lemons were exported there and realized approximately £1 per case—not individual cases, but consignments of several hundreds. Apart from export, the possibilities are here in the North for development to displace the heavy importation of fresh lemons, candied and pickled peel, essence and oil of lemon, citric acid, &c.; and with fruit drinks growing in popularity there can be no doubt that our home markets are capable of absorbing larger quantities of locally-grown lemons. It is apparent, however, that a larger proportion of high-quality product is necessary to hold the local market against the imported lemons.

Probably the most serious drawback to profitable culture of lemons is the large amount of second-grade and cull fruit grown. As might be expected with an introduced plant under conditions varying from the natural habitat, decline is more likely to result naturally than a disposition to improvement. Therefore very keen attention and constant vigilance to select the best from which to propagate is required. New Zealand nurserymen are to be congratulated on having maintained the desirable types at so high a pitch, and it is pleasing to record that every year sees them more enthusiastic in the matter, so that practically the whole of the buds used for propagating this year are from trees specially selected by the Institute of Horticulture. This will do much towards ensuring a larger output of high quality, as with trees of selection the basis is right, without which the cultivation would be handicapped. This, of course, is not all that is required, constant care and a high degree of skill being also needed to bring the trees to profitable perfection; but it is the nurserymen's part to lay the foundation in a manner that will reflect credit on the industry to which he belongs and profit to the Dominion.

The varieties of citrus-fruits suitable for commercial planting are somewhat restricted, and attention should be confined to those of approved merit. New varieties are constantly being introduced and tried out, but it would certainly not be wise to plant on a large scale varieties other than those which have proved their worth. Of the lemons, Lisbon is favourite with us; it is a very adaptable tree to a wide range of soil conditions and of good robust constitution and heavy fruiting habit. Eureka is now grown approximately to the same extent as Lisbon, and gives equally good returns of somewhat better-shaped fruit. Eureka is a thornless tree, and preferred by some for this reason. A good planting is equal numbers of Lisbon and Eureka, which affords an almost continuous supply of fruits. Villa Franca, Messina, and Sicily are varieties which have been under observation for some years, but have not disclosed any special merit to justify them being planted in preference to Lisbon and Eureka. Genoa and Meyer are of comparative recent introduction, and are worthy of trial in a limited way.

Oranges.

Of the preserving oranges, the well-known Poorman retains its place as the most suitable. Seville is now little grown here, being considered too bitter, and Kin Kan—which was introduced a few years ago—is proving too coarse in texture and far too seedy to be readily acceptable.

There is a decided leaning in this country towards the use of the Poorman orange as a breakfast grapefruit, the larger sizes being particularly suitable for this purpose. The true grapefruits, Marsh's Seedless and Foster, are both being grown here, but there is no indication that they are worthy of cultivation for profit. The Poorman orange is really a kind of pomelo, and its larger fruits will meet with keener demand as time goes on and the use of breakfast fruit becomes more general in New Zealand. It is, therefore, a dual-purpose orange—preserving and dessert.

Though sweet oranges grow well in most parts of our citrus areas, they do not thrive with sufficient luxuriance to economically compete with the produce of the Pacific islands and parts of Australia. Until, therefore, a variety is introduced which will succeed considerably better than any now grown, it would not be wise to undertake sweet orange growing as a commercial proposition. Nevertheless, they can be grown quite well for domestic purposes, and there are instances of late fruits being profitably marketed after the Island season is finished. The most satisfactory variety to plant is Valencia Late, as it hangs for a longer period on the tree to mature, and at the same time retains its juice. Navelencia is the next to be preferred, while Best's Seedless, a variety of local raising, does quite well when the trees get older, but does not come into bearing nearly as early as Valencia or Navelencia. St. Michael, Jaffa, and Mediterranean Sweet are also grown locally, but are usually of smaller size and variable in quality.

Like the sweet orange, the mandarin is hardly worthy of extensive cultivation here for commerce, but where a few trees are to be grown Emperor, Thorny, and Scarlet will give good results. A wide range of the citrus family may be grown as ornamental if not profitable plants, and add charm to Northern gardens.

THE LOQUAT.

Another subject worthy of more attention is the loquat. This highly ornamental species (*Eriobotrya japonica*) luxuriates in the North, but it is perhaps the most disappointing fruiting tree grown, undoubtedly owing to its indiscriminate propagation from seeds. The trees most frequently seen are haphazard fruiters, not even maintaining a biennial or triennial fruiting habit. This has given a false reputation to a desirable fruit, and at present the loquat is grown more as an ornamental and shelter tree from which fruit is occasionally picked. There are, however, available from nurserymen worked trees of superior quality, varieties which, although quite as ornamental and suitable for shelter trees, have more constancy of fruiting and better quality. The fact that the period for marketing loquats is when other fruits are scarce invariably means good prices, and when one considers that mainly Australian-grown fruit is sold retail here, and compares the freedom of growth in this country, one can only assume that better and more constant fruiting varieties would make loquat growing a profitable side-line from shelter trees, or even as a section of a commercial orchard.

THE GUAVA.

Plants established throughout the Auckland District show that two species of guava are of wide distribution, these being *Psidium Cattleyanum* and *Psidium Guyava*—the purple and yellow varieties respectively. Of the older plants which are succeeding, the purple predominates and is undoubtedly the hardier. There are a very few aged plants of the yellow variety, though it is quite common in nurseries. As domestic plants both are useful, fruiting as they do in the off-season, and meeting a wide range of uses—preserves, jellies, cooking, and dessert. As a commercial proposition, however, the yellow does not promise as well as the purple. Undoubtedly the yellow kind is larger and of better dessert quality, but this is a fact also known to the birds, who greedily devour most of the yellow fruit grown. The yellow variety is also disposed to shed its fruit when half-matured.

A very pronounced feature of the older fruiting trees is the wide range of strains grown. Occasionally a plant is found producing superior-sized fruits with a refined seed, while others—under the same conditions—are not worth cultivation as fruiting plants, though highly ornamental. It should be the duty of every propagator to select from the best type only, in order that evolution of this species may be assisted, or to adopt vegetative reproduction so as to avoid the wide range to be expected from seedlings.

Though there is a very limited area planted in guavas in a methodical orchard way, there is sufficient to indicate that this is not the most economical way to grow the plant. The most profit from a minimum area of land is returned when these plants are used as a dividing hedge. They thrive best in close company, crop quite well, and provide a very desirable hedgerow, but should not be expected to act as a breakwind to south or south-west winds.

Further introduction of allied species might be profitably done, particularly from Norfolk Island, where, I understand, the species common to New Zealand has quite superior variations.

FEIJOA.

A warm-climate fruit of recent introduction, which will no doubt become quite popular, is *Feijoa sellowiana*, of the myrtle family, a highly ornamental shrub with mid-green foliage, silver on the reverse side. It has a very symetrical growth which carries a profusion of quaint flowers—purple, white, and blue in pleasing combination, the petals are thick, fleshy, and sweetly flavoured. The highly perfumed late autumn fruit, about the size of a walnut, is of a sweet pineapple-strawberry flavour, but lacks acid. Mr. Hayward Wright, of Avondale, has some fine specimens of feijoa which have demonstrated its suitability to the Auckland climate. As an ornamental plant it is to be highly recommended, while the fruit is a decided acquisition.

PASSION-FRUIT.

Passion-fruits are most accommodating plants to the varying conditions of the North. Of this branch of the Granadilla family *Passiflora edulis* succeeds to best advantage for commercial purposes. Though the long white variety does quite well it is most suitable for

domestic purposes near the point where it is grown, owing to the softer nature of the rind. Of the purple passion-fruit the Mammoth variety is certainly more attractive, owing to size, but this is the only advantage it possesses over the smaller variety. The ordinary small *edulis* can be depended upon to set a prolific crop sufficient to compensate for the lack of size, so that the output per acre is equal. The Mammoth is prone to partial infertility, and produces many semi-hollow fruits, a fault rarely met with in the smaller variety. Fullness of pulp is a great commercial asset, as consumers soon become dissatisfied with sham fruits and restrict purchases. Rapidity to wilt and become corrugated after picking is also more pronounced in the Mammoth than in the smaller variety.

The case of cultivation, which is only marred by certain obscure troubles of establishment after transplanting, is such that it is surprising that a greater extension is not made. Though a plantation is more of a temporary nature than most vine or tree fruits the time between planting and fruiting is less, and returns are thus secured much earlier, an advantage with new settlers and others desiring a semi-temporary catch-crop between wide-spaced orchard trees. The local markets are capable of absorbing at payable prices considerably more passion-fruit than is at present grown, while the overseas market is as yet only touched. Australia is planting extensively for export to Europe as fresh fruit and pulp, so that quantities should soon be going forward sufficient to make an impression. Therefore, with only high quality fruit exported from this Dominion, we can confidently look forward to the best returns from Europe. High quality only is mentioned advisably, as it is only that quality which will pay. The production of a large proportion of low-grade fruit would seriously affect the profits of a plantation.

The passion is more accommodating than most fruit, inasmuch as fruits of inferior size and appearance may be used for pulp. On the other hand, the ease of propagation is such that strains of low quality are more apt to be perpetuated, for to a large extent the propagation is not in the hands of highly skilled propagators, but undertaken by all and sundry. Every effort should be continued by nurserymen to select seeds of advanced quality and prolonged fruiting habit, and to produce plants which will become known as superior to home-raised; it is only by such selection that the general average of quality can be maintained or raised. There is also room for a considerable amount of research work with the object of determining other varieties of the Granadilla family suitable to conditions here. It is well within the bounds of horticultural possibility that a hybrid could be raised which might exceed all others in quality and become of considerable commercial value to the Dominion.

TREE TOMATO.

Cyphomandia betacea is most luxuriant in growth and prolific in fruiting in localities free from wind and frost. Quite profitable crops are grown on plants three years from seed, and though the plants are more or less of a temporary nature—say, ten years—the produce is absorbed locally at prices which make growing profitable. The plants will withstand only slight frosts, and their culture is impossible in

other places. High winds are very detrimental, and may make an otherwise suitable locality impractible for tree-tomato culture. Too close or dense a shelter creates conditions suitable to mildew, practically the only disease which affects these plants, so a naturally wind-free situation is to be desired.

It is generally conceded that consumers have to acquire a liking for the peculiar flavour of the tree-tomato before partaking freely of the fruit; nevertheless, the demand is quite keen for dessert purposes, while the fruit is eagerly sought after for preserving. The suitability of tree-tomatoes as a pie fruit requires only to be better known to be more appreciated, available as they are in the season of shortage of soft pie-fruits. Possibly the greatest improvement on existing varieties could be made in the direction of extending the season, as the very late and slightly out-of-season fruits command luxury prices at present.

THE AVOCADO.

An example of a fruiting plant attaining great commercial value in a short space of time is the development of *Persea grattisima* on the American Continent. Two races, natives of the West Indies and Guatamala, have been used to evolve the modern commercial variety, which has been extensively planted in Florida and California and is meeting with a keen demand in the United States generally.

The avocado is a handsome evergreen tree, mature at from 25 ft. to 30 ft. The fruits are pear-shaped, about the size of a large pear, and contain a large single seed. When ripe the skin parts easily from the pulp, which is of firm though buttery consistency, and with pepper and salt makes a perfect salad in itself. Few people fail to like it even at first trial. The fruit is highly charged with a nutritious oil, which is quite agreeable to the palate. Plants have been established here for some years and do quite well in frost-free areas. Mr. J. H. Davidson, of Tauranga, has fruited some trees, and has a range of varieties under trial, by arrangement with the Department of Agriculture, while many other plants are distributed throughout the North. Many nurserymen are now offering plants propagated in the most approved manner for avoiding any risk of seedling variations, and it will be highly interesting and probably profitable to foster the establishment of the correct variety in the more subtropical parts of the Dominion. It is hardly to be expected that we shall produce such luxuriant fruits as in the tropics, but owing to the susceptibility of the avocado to fruit-fly it is not likely that this market will ever be supplied from outside countries, and the hardier varieties may succeed here quite well enough to give the people the benefit of this highly nutritious and agreeable dessert fruit.

OTHER VARIETIES.

Other subtropical fruits known to grow well but not fruit luxuriantly in the Auckland District include the following: *Casimiroa edulis*, the white sapota of Vera Cruz; *Zissiphus*, the true jujube; and *Punica granatum*, the pomegranate of commerce. There are also enormous latent possibilities in the adoption of fig-culture, providing the right varieties are introduced or raised.

TOP-DRESSING EXPERIMENTS ON PASTURE IN OTAGO.

PRELIMINARY TRIALS, SEASON 1926–27.

R. B. TENNENT, N.D.D., Instructor in Agriculture, Dunedin.

THREE co-operative top-dressing experiments, laid out in such a way that the results could be statistically examined, were conducted in the South Otago district during the past season. These experiments were intended to serve as a forerunner to a comprehensive programme of grassland experimentation, embracing the whole of Otago, which has been arranged for the coming season of 1927–28. A mass of general information, based largely upon observation only, has been obtained during past years as to the result of various top-dressings, but so conflicting were the impressions gained that it was decided to ascertain if possible by a series of well-conducted experiments the relative merits of certain fertilizers when applied to varying types of pastures under different soil and climatic conditions.

The common, and apparently unavoidable, practice of breaking up every four or five years what were originally intended to be permanent pastures, and then resowing them again, has been in vogue to a great extent in the South, involving the farmer in an ever-recurring expenditure every few years of anything from £3 to £6 per acre. The experiments now in hand are intended to ascertain whether the life of the pasture cannot be considerably lengthened and maintained in a high state of palatability with a comparatively small expenditure by the application at periodical intervals of moderate quantities of manures.

Much is heard in the South of the effect of lime, alone or in conjunction with phosphates, in invigorating the growth of grass, and lime has accordingly been incorporated with this series of experiments to determine its effect. The residual effect of the various fertilizers is of undoubted value, and an effort will be made to ascertain the number of years over which such effects will be felt.

The Past Season's Trials.

Two experimental plots were laid down in the Crookston district and one at Awamangu. The fertilizers used were 44–46 per cent. superphosphate, basic slag (Anchor brand), and ground carbonate of lime ($CaCo_3$). The three experiments were laid out in an exactly similar manner, the drill strip method, which has previously been described in this *Journal*, being utilized. Sufficient replications of strips were made to reduce to a minimum any soil-variations which might exist. The plots were established with the objects of carrying them on for at least four years. The following briefly summarizes the experiments :—

(1) FARM OF T. REVIE, CROOKSTON.

For the purpose of this experiment an old pasture was selected on land which might be described as good heavy agricultural land. The pasture could not be called a good one, having run largely to brown-top, crested dogstail, and Yorkshire fog, but it also contained a fair

proportion of perennial rye-grass, cocksfoot, and white clover. The pasture had obviously started to run to inferior grasses, and appeared to be one typical upon which to experiment. The quantities per acre of fertilizers and lime used were as follows: Basic slag, 2½ cwt.; superphosphate, 2½ cwt.; carbonate of lime, 1 ton. Top-dressing was carried out on 17th August, 1926; the plot was closed to stock on 29th October; and harvesting took place on 19th January, 1927, a period of nearly thirteen weeks after closing. The following table gives a summary of the results obtained:—

Table 1.

Treatment.	Average Green Weight of Plot.	Probable Error.	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
	lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
Basic slag and lime	50·6	±1·41	1 8 1	7 1 3	1 9 7½	Loss 1 10 10½
Basic slag ..	54·7	±1·55	1 10 3	7 13 7	0 15 7½	Loss 0 4 6½
Super and lime ..	64·3	±0·94	1 16 0	9 0 0	1 9 3¾	Gain 0 8 2¼
Super	64·4	±1·28	1 16 1	9 1 3	0 15 3¾	Gain 1 3 5¼
Lime	49·6	±1·28	1 7 3	6 19 8¾	0 14 0	Loss 0 16 9¼
Control	50·9	±1·68	1 8 2	7 2 6	..	..

In the case of this experiment the plot could have been shut up earlier—say, about 1st October—so as to give greater growth for weighing. As will be observed, superphosphate on this season's results gave the greatest increase of hay per acre over the control—namely, 7 cwt. 3 qr. per acre. Basic slag gave an increase of 2 cwt. 1 qr. per acre. Lime showed no increase whatever, nor was its effect shown in combination with either superphosphate or basic slag.

(2) FARM OF W. H. LUSK, CROOKSTON.

The pasture selected for this experiment had deteriorated very much, and looked most unpromising in so far as any attempt at rejuvenation was concerned. Brown-top, fog, and crested dogstail predominated, although vestiges of cocksfoot, perennial rye-grass, and more particularly white clover remained. The soil conditions were similar to those obtaining on Mr. Revie's plot. The quantities of fertilizers applied were as follows: Basic slag, 2½ cwt.; superphosphate, 2½ cwt.; carbonate of lime, 1 ton, per acre. The plot was top-dressed on 18th August, 1926, shut up on 2nd December, and mown on 20th January, 1927, having been closed for a period of seven weeks. Table 2 summarizes the results obtained.

This plot, unfortunately, was closed for only seven weeks, and the resultant poor growth was insufficient to give marked increases. However, as could be expected, the results closely parallelled those obtained on Mr. Revie's plot, in that superphosphate showed the greatest gain over control—3 cwt. 3 qr. per acre—whereas neither basic slag nor lime showed any increase, nor was the effect of lime shown in combination with either superphosphate or basic slag.

Table 2.

Treatment.	Average Green Weight of Plot.	Probable Error.	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
	lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
Basic slag and lime	38·1	±1·75	1 1 2	5 7 6	1 9 7½	Loss 1 15 10½
Basic slag ..	40·5	±2·61	1 2 3	5 13 9	0 15 7½	Loss 0 15 7½
Super and lime ..	46·5	±1·54	1 6 1	6 11 3	1 9 3¾	Loss 0 11 9
Super	46·8	±2·47	1 6 2	6 12 6	0 15 3¾	Gain 0 2 5¼
Lime	38·4	±1·47	1 1 3	5 8 9	0 14 0	Loss 0 19 0
Control ..	40·5	±2·08	1 2 3	5 13 9	..	..

(3) FARM OF D. SMOLLET, AWAMANGU.

For this experiment a young pasture two years old, consisting largely of perennial rye-grass, cocksfoot, red clover, and white clover, was utilized. It was situated on good hill-country, and was selected largely on account of the short-lived nature of pastures of this type in the Awamangu district. In this case heavier dressings of fertilizers were used than with the other experiments, the amounts being as follows: Basic slag, 5½ cwt.; superphosphate, 3¾ cwt.; and carbonate of lime, 1 ton, per acre. The top-dressing was done on 19th August, 1926; the plot was closed to stock on 18th October, and harvested on 25th January, 1927, a period of fourteen weeks. The following table summarizes the results:—

Table 3.

Treatment.	Average Green Weight of Plot.	Probable Error.	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
	lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
Basic slag and lime	92·1	±2·42	2 12 0	13 0 0	2 7 0	Gain 2 3 0
Basic slag ..	91·1	±1·41	2 11 1	12 16 1	1 13 0	Gain 2 13 1
Super and lime ..	64·7	±2·36	1 16 2	9 12 6	1 16 6	Loss 0 14 0
Super	62·5	±1·68	1 15 0	8 15 0	1 2 6	Loss 0 17 6
Lime	64·3	±1·88	1 16 0	9 0 0	0 14 0	Gain 0 4 0
Control ..	60·7	±1·75	1 14 0	8 10 0	..	..

The results obtained from this experiment are most interesting, and quite the reverse to those obtained in the Crookston district. It will be seen from the table that basic slag and lime gave the greatest gain over the control plot—namely, 18 cwt. per acre. Basic slag alone gave an increase of 17 cwt. 1 qr. per acre; superphosphate and lime a gain of only 2 cwt. 2 qr.; and super alone a gain of 1 cwt. Lime in this case gave a gain of 2 cwt. per acre.

GENERAL SUMMARY OF RESULTS.

(1) It is to be borne in mind that the results obtained from the various fertilizers cannot be correctly evaluated until the expiry of at least four years. It is intended to carry out the experiments for that length of time.

FIG. 1. BASIC SLAG PLOT ON MR. SMOLLET'S FARM, AWAMANGU, SHOWING PROFUSION OF RED CLOVER.

FIG. 2. SUPERPHOSPHATE PLOT IN SAME TRIAL ON MR. SMOLLET'S FARM.

(2) The whole cost of the various fertilizers has been charged against the value of the hay taken off the plots during the short period of time during which they were closed to stock. This is not fair to this year's hay crops, for undoubtedly the effect of the fertilizers will be felt over a number of years.

(3) The gauge utilized in recording the effect of the fertilizers was the increase in weights of hay obtained. No credit so far has been accorded to the respective increase in nutritive value of herbage between controls and top-dressed plots.

(4) At Crookston, contrary to general expectations, carbonate of lime showed no increase over the control plots, despite the fact that a wet season was experienced, while in the Awamangu district lime showed a slight increase.

(5) At Crookston superphosphate proved, on this year's results, the best fertilizer to use on old pasture.

(6) At Awamangu basic slag was pre-eminently superior to superphosphate on a comparatively young pasture.

Thanks are due to Messrs. Revie, Lusk, and Smollet for their unfailing interest and co-operation in connection with the trials. Acknowledgment is also made of the assistance given in the conduct of the experiments by Messrs. Duff and Hume, of the Fields Divison.

THE PRUNING OF ORCHARD TREES.

W. K. Dallas, Orchard Instructor, Dunedin.

Pruning is one of the most important of the many operations to which the commercial orchardist has to give his attention. It is an operation which calls for the highest degree of skill, for on the manner in which the work is carried out largely depends the following and subsequent seasons' crops. The various varieties of the different kinds of fruits call for different treatment; the trees of the same variety in different localities, and in the same orchard, require individual attention and treatment.

The primary object of pruning is to obtain a greater quantity of high-grade fruit; secondly, the young tree is pruned to a desired shape; thirdly, pruning is practised to renovate trees for the purpose of returning them to profit and to a suitable shape. To become a successful pruner an elementary knowledge of how plants grow is essential. The lack of this special knowledge has been the cause of keen disappointment to many an amateur pruner. For the different kinds of fruit-trees there are various systems and ideals of pruning. It is important for the pruner to have a clear mental picture of the ideal he is striving for; he must clearly understand the objects and principles of pruning.

It is also necessary for the orchardist to realize that no matter how skilfully pruning is done to develop trees of normal stature and capable of producing large crops of high-grade fruit, he must not expect to secure satisfactory results unless the soil is in such good condition as to furnish sufficient food and moisture when required, in order to ensure the development of good strong fruit buds. Pruning is not a cure for all the ills that a tree is subject to. The fruitgrower must realize and appreciate the importance of such orchard operations as cultivation, drainage, and maintenance of soil-fertility.

BUILDING UP THE FRAMEWORK.

For success in training the young tree the pruner before he begins must have a clear mental picture of the mature tree. One of the greatest necessities of a good tree is a substantial framework. The

rod should be cut at a height of not more than 20 in. from the ground-line. Experience has shown that trees headed back to this height are the easiest to care for, and that they are the most economical for pruning, spraying, thinning of the fruit, and harvesting of the crop. The trunk and limbs are more shaded from the sun on a low-headed tree. A spiral of three or four buds equidistantly spaced around the rod should be selected. The farther apart they are from one another the stronger and better will be the framework. A stub of good length should be left above the topmost bud of the spiral so as to throw the topmost branch out, in order to give a broad base to the tree; this stub is to be removed the following season. Every endeavour should be made to avoid sharp-angled crotches.

At the next pruning three or four main branches equidistantly spaced round the trunk should be selected. These branches should be cut back, according to their strength, from 8 in. to 10 in., the strongest branches the most severely and the weakest the least. Thus the leaf area of the stronger branches will be reduced and the leaf area of the weaker increased, and this will give a balance and cause weak branches to gain their proper strength. This cutting-back tends to make the limbs more stocky. At the following winter pruning select from six to eight conveniently placed strong branches, which should be cut back, leaving 12 in. or 14 in. A few of the short twiggy growths which have developed on the main arms may be left uncut.

At the following season's pruning select ten to sixteen suitable branches as leaders, which should be cut reasonably long so as to avoid forcing the tree into excessive and heavy wood-growth. As regards apple-trees, lateral growths which are being retained should be left not less than 8 in. long in the case of Sturmers, 12 in. in Jonathans, and 14 in. on strong-growing varieties such as Delicious.

DEVELOPMENT OF FRUITING-WOOD.

When treating the laterals many growers make the mistake of thinning these out too much and cutting them back far too severely. They should be thinned in such a manner as to distribute them evenly over all parts of the tree. Should too many be left they may be removed or shortened back after the tree comes into bearing. The trees having passed through the period of framework-building should now have good trunks, limbs, and branches, and should be approaching the period when they will commence bearing good crops.

In addition to good crops, uniformity, reasonable size, high colour, &c., are desired with all our fruits, and to obtain and maintain these a light annual pruning is required. It is generally recognized that thinning is necessary on heavily bearing trees for production of fruits of the characteristics just mentioned, and this may be conveniently done at the time of pruning. By thinning out the fruit-buds and fruit-spurs those remaining should be invigorated and yield a better class of fruit. The amount of fruiting-wood to be left on the trees at this stage of their existence is a matter which the orchardist must decide for himself, ever bearing in mind that the good growth of his trees is a first consideration. The pruner should attempt to develop a reasonable amount of new wood annually, in order to provide for

the necessary increase of new buds and spurs, which are essential if the trees are to remain productive over a period of years.

It should be kept in mind that pruning is done first with the object of building up a strong symmetrical framework, and then of developing the maximum amount of fruit-bearing wood possible. Do not allow the tree to overbear. Maintain the soil in good condition, and keep it supplied with such plant-food as will cause the trees to thrive. Keep the centre of the tree reasonably open. No one leader should be allowed to take the lead; all should be kept as evenly balanced for strength and position as possible. Make all cuts carefully. Keep under control diseases which affect the trees.

There are many trees of such weakly and stunted condition that it is difficult to decide which is the proper method of treatment to obtain the desired results. Growers who do not thoroughly understand the practices of pruning or their application to particular trees in the orchard should seek the assistance of the district Orchard Instructor.

STONE-FRUITS.

Peach and Nectarine.

The peach and nectarine may be taken together, as their fruit-bearing habits of growth are very similar. The fruit is produced on the past season's wood, and occasionally varieties will be found bearing fruit on short spurs. The fruiting-buds of some varieties are situated nearer the terminal of the laterals than is the case in other varieties. The bearing habit of the variety will, however, dictate the method of pruning to be adopted. The trees require to be kept growing vigorously by cultivation, manuring, spraying, and pruning, in order that they may produce a sufficient annual lateral growth of from 18 in. to 20 in. long and so that they may be kept well furnished with bearing-wood. The new growth only bears fruit in the season following its production and then becomes barren. If left unpruned each season, as the new growths extend they become shorter and ultimately unfruitful. Those situated on the lower portions of limbs frequently die. A peach or nectarine tree will soon run itself out if new growth is not maintained.

Being possessed of this knowledge, the operator must prune in such a manner as to maintain an even distribution of strong lateral growth over the whole surface of the tree. The system recommended for the treatment of bearing trees is to keep the leaders well spaced, and in normal vigorous trees cut back just hard enough to induce a sufficient development of lateral growth throughout the tree, a the same time avoiding too thick a growth in its head. The wood to be retained for fruit-bearing purposes should be carefully chosen from the shorter, well-matured laterals, and should be spaced as evenly as possible over the whole tree. Cut away the very strong-growing laterals. The medium to strong well-ripened laterals are the best for fruiting purposes. When cutting out laterals do not cut them so close to the collar as to damage the dormant buds at the base of the shoot.

With the knowledge that the fruit will be borne on the one-year-old wood the pruner must decide whether the laterals shall be reduced in length or left uncut. On this point opinions differ. Some growers are in the habit of shortening these laterals back; experience, however,

has shown that they give better results if left uncut. It very frequently happens that when laterals are shortened the stronger and better buds are cut away and the weaker ones left, and these latter often drop off about blossoming-time. When laterals of this kind are left full length they will invariably break into growth towards the base, as well as making terminal growth. The laterals which fruited last season should be cut back at the base or back to the lower new wood which has developed on them. The new wood that is retained will carry the crop in the following season.

It is good practice to cut away at pruning all lateral growth which has fruited, and retain only the new lateral growths. In this way well-cared-for trees will always produce sufficient fruiting-wood. With light pruning heavy crops can be secured for a few seasons, and then the trees will ultimately run out. It is essential that the pruning be hard enough to induce a plentiful supply of new growth, so as to maintain good crops. In all cases where the trees are carrying an overload of fruit the fruit should be thinned early in December. Immediately after the fruit has set, laterals which are not carrying fruit should be cut back to the collar or to a developed bud near the base, in order to force new lateral growth from near the base of the shoot.

Apricot.

The apricot crops both on the previous season's laterals and on spurs. With most varieties the tendency is for the spurs to die out after two or three seasons, commencing from the base of the laterals; consequently, if left unpruned, laterals in time only produce fruit toward their tips. This may be avoided by following a system of renewal similar to that described for the peach. In normal growth the apricot produces less new wood than the peach, so that the pruning will mainly consist of cutting back the leaders, and thinning out and cutting back the laterals just sufficiently to keep up a sufficient supply of short healthy fruiting-wood and spurs. If extensions or replacements are necessary the stronger of the season's shoots, where growing in suitable positions, may be used to add to the fruit-bearing surface of the trees.

Most varieties of apricot spur freely, and the laterals produced may be cut hard back. An exception is the Roxburgh Red; the laterals of this variety which are retained for fruiting should not be shortened back.

Plum.

The plum requires different pruning from the peach. The habit of growth and fruiting of the European and Japanese varieties is different. The European varieties bear their fruit on spurs that are developed on wood two years old or older, while the Japanese varieties bear their fruits on wood developed during the past season and on spurs on older wood. European varieties rarely fruit on one-year-old wood, and are longer in coming into bearing than the Japanese type. An endeavour should be made to get as large a framework as possible during the early years of the tree. When the period of fruit-bearing arrives the pruning should consist of only a thinning-out of misplaced branches and laterals. Where necessary a shortening-back of the longer laterals can be made. Generally speaking, the greater number and best of the

fruits are borne on two- and three-year-old spurs on fairly strong lateral wood. Fruit is also borne on older spurs, but it is not, generally speaking, of such fine quality as that produced on the younger spurs. After four or five years fruiting the spurs become barren and die. To obtain regular fruiting and good crops it is necessary that a moderate supply of new lateral wood, with which to replace the older and worn-out parts, be produced each year.

The Japanese plum will bear fruit on one-year-old wood as well as on spurs on the older wood. The best fruits are generally borne towards the base of the one-year-old wood. The pruner should not overlook this point, for as a rule Japanese plums are prolific bearers, and small plums of this type do not pay for the harvesting and marketing. The operator must prune for large fruits, and to obtain this object good strong annual growth should be encouraged and the weaker growths and spurs thinned out. On account of the spreading and struggling habit of the Japanese plum it is difficult to secure a nice, well-balanced tree.

Cherry.

The cherry-tree that is thriving and has a well-formed strong framework requires little pruning. Every endeavour should be made in the training of the tree, by careful cutting-back of the leaders, to develop a low-spreading head similar to that of an apple-tree. The cutting-back beyond one-year-old shoots to promote branching is not recommended, because it frequently happens that where the leader is cut back into two- or three-year-old wood new side branches do not develop. In circumstances where trees lack the necessary vigour even cutting into one-year-old wood fails to produce the desired result. Cherry-trees should be kept growing moderately strongly and not allowed to become stunted.

The bearing habit, apart from the spurs developed on the leader growth, is always towards the ends of the shoots. The fruiting-wood should be well distributed on the limbs. In pruning to produce fruiting-wood care must be exercised not to overprune and force strong growths, as these are usually not as fruitful as the shorter laterals. Branches requiring cutting should be cut back only to a shoot or strong spur.

If left unpruned the cherry spurs will deteriorate after bearing regularly for a number of years, and will produce small inferior fruit singly instead of in clusters, and finally die.

NOTE.—The pruning of pip-fruit trees will be dealt with next month—concluding this article.

Quality in Butter and Cheese.—In the course of a recent address to dairy-factory managers, Mr. W. E. Gwillim, Assistant Director of the Dairy Division, remarked: "The improvement in the quality of our produce this season provides good reasons for congratulation. The great advance in the quality of cheese is particularly gratifying. It evidences good work on the part of milk-suppliers and of cheesemakers. It is generally agreed that about one-half the credit for the quality of cheese and butter is due to the supplier. Of the 100 grading-points available, 50 are obtainable for flavour, and the chance to get the right flavour rests primarily with the supplier. The most a cheesemaker or a buttermaker can do is to show the flavour in the most favourable light. The other obtainable points are principally for workmanship. As a minimum of 28½ points is required for body and texture in cheese to secure 'finest grade,' it is apparent that plenty of good workmanship has been put into cheesemaking this season."

DESTRUCTION OF TALL COUCH.

EXTENDED EXPERIMENT IN MARLBOROUGH.

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IN the *Journal* for February, 1926, there appeared a short account of an experiment in the destruction of tall couch (*Agropyron repens*). Since making that report the writer has received so many inquiries from various parts of the Dominion as to the subsequent history of the paddock from which the seed crop of tares was taken that it seems advisable to publish some later particulars and photos for general information.

It may be recalled that on Mr. R. F. Goulter's farm, near Blenheim, a 40-acre block badly infested with couch was selected for experiment. In March, 1924, after the preliminary cultivation previously described had been carried out, Algerian oats and Scotch tares were sown at the rate of 2 bushels of oats and 1 bushel of tares per acre. During the succeeding winter this crop was grazed off-and-on with 400 ewes, a grass paddock adjacent to the oat and tare field being employed as a run-off. In the following spring grazing was continued on 22 acres of the oat and tare crop. At the end of February, 1925, every lamb was sent away fat. The 22 acres grazed ran back badly to couch. Of the other 18-acre paddock, 12 acres was cut for hay early in November, 1924, while the remaining 6 acres was carried on as a tare seed crop, the yield being 33 bushels per acre, and the price realized 8s. per bushel. As previously pointed out, the success of the seed tare crop as a smother was excellent, while the portion from which the hay was cut was also very much cleaner than the grazed area.

The subsequent history of these paddocks is briefly as follows: From autumn, 1925, to autumn, 1926, no crop was sown either in the 22-acre or in the 18-acre paddock; the 22-acre paddock containing couch was, however, lightly grazed with sheep from time to time. In the early autumn of 1926 the 18-acre paddock was sown with 2 bushels of Algerian oats and 1½ bushels of Scotch tares per acre. The mixed crop was harvested this autumn (1927), the yield being 20 bushels of tares plus 36 bushels of oats per acre—quite a profitable yield. The paddock has been ploughed and worked up again this autumn, and a sowing made at the rate of 2 bushels of tares and 1 bushel of Algerian oats per acre. Similarly the 22-acre paddock infested with couch, which was previously stocked, has been worked and similarly sown with oats and tares.

The accompanying photos, taken on 31st March last, illustrate the state of the paddocks. It will be noted from Fig. 1 that in the case of the 18-acre area, which has grown the seed tare smother-crop twice in succession, the ground is extremely clean, the only plants observable after cultivation being self-sown oats and tares. The photo (Fig. 2) of the 22-acre paddock, which was sown with oats and tares in the autumn of 1924 and fed off, but neither hayed nor seeded, shows distinctly that after three years tall couch is still much in evidence.

FIG. 1. GROUND IN 18-ACRE PADDOCK FREE OF TALL COUCH, AS SEEN THIS AUTUMN.

The only plants showing are self-sown oats and tares from the last crop.

FIG. 2. BAD PATCH OF TALL COUCH IN 22-ACRE PADDOCK WHERE OATS AND TARES CROP WAS FED OFF—NOT SEEDED.

It will be readily admitted, after considering the evidence furnished by the paddock which has been systematically cropped for seed tares, that the result after three years is highly satisfactory. The old system of scarifying and summer fallowing as generally practised in Canterbury cannot compare for effectiveness with the system here recorded.

Phosphatic fertilizers are of three types: (1) Phosphate immediately available—superphosphate; (2) phosphate moderately available—basic superphosphate; (3) phosphates slowly available—basic slag, rock phosphate, bonedust.

IMPORTATION OF FERTILIZERS, 1926 27.

Chemistry Section.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1927, have been prepared as usual from figures specially supplied by the Comptroller of Customs, and are presented in the accompanying tables, together with comparative data for preceding periods.

TABLE 1.—SUMMARY OF FERTILIZER IMPORTATIONS, 1926–27 AND 1925–26.

Fertilizer.	Quantity.		Declared Value.	
	Year 1926–27.	Year 1925–26.	Year 1926–27.	Year 1925–26.
	Tons.	Tons.	£	£
Bonedust	1,805	2,085	15,932	18,851
Bone-char	..	309	..	1,270
Basic slag	53,327	44,314	185,139	139,136
Superphosphate	15	500	89	1,856
Nauru and Ocean Islands phosphate	125,709	77,797	165,803	98,827
Island phosphate (other)* ..	35,832	19,691	56,868	34,272
Egyptian phosphate	5,979	10,037	18,730	32,363
American rock phosphate ..	21,977	..	32,485	..
Nitrogenous guano	..	20	..	236
Kainit	2,195	3,110	6,295	8,214
Muriate of potash	..	25	..	145
Sulphate of potash	2,016	1,356	19,740	13,728
Potash (other)	6,474	4,238	27,565	16,749
Gypsum	..	1,402	..	2,220
Sulphate of ammonia	957	1,227	12,862	17,037
Nitrate of soda	1,466	1,284	17,057	16,033
Sulphate of iron	61	67	658	743
Fertilizers unspecified	57	..	640	247
Totals	257,870	167,462	559,863	401,927

* For details see Table 3.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1917–27.

Year ended 31st March.	Bonedust.	Basic Slag.	Superphosphate.	Pacific and Indian Oceans Phosphates.	Egyptian Basic Phosphate.
	Tons.	Tons.	Tons.	Tons.	Tons.
1917	10,386	6,660	31,902	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000
1921	4,440	10,823	40,731	70,208	10,810
1922	4,063	13,488	3,140	45,956	Nil.
1923	2,446	19,641	Nil	69,591	,,
1924	4,158	39,632	255	76,517	5,996
1925	2,452	45,682	10	108,163	8,530
1926	2,085	44,314	500	97,488	10,037
1927	1,805	53,327	15	161,541	5,979

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR 1926–27, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.		Chile.	India.	Pacific and Indian Oceans Islands.		United Kingdom.		Belgium.		France.		Germany.	Egypt	United States of America.	
	Nitrogenous Manures.	Bonedust.	Nitrate of Soda.	Bonedust.	Name of Island.	Phosphate.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Potash.	Phosphate.	Nitrogenous Manures.	Rock Phosphate.
					New Caledonia ..	442	..	..	..	..	..	..	..	..	..	..
					Seychelles ..	1,429	3,455	145	20,203	125	100	3,306	2,386	..	150	14,673
					Surprise ..	3,881	..	..	..	..	..	..	..	..	..	..
Auckland	287		155	1,466	1,650 Malden ..	2,245	..	..	..	..	..	..	..	..	..	..
					Nauru ..	44,382	..	..	..	..	..	..	..	..	..	..
					Makatea ..	10,946	..	..	..	..	..	..	..	..	..	..
					Ocean	31,715	..	..	..	..	..	..	..	..	..	..
New Plymouth ..	56	..	..	..	Nauru	14,145	10,191	71	..	1059	9,496	479	1,212	..	..	..
					Ocean	3,884										
Wanganui ..	25	..	..	..	Seychelles ..	1,040	..	..	..	..	..	..	..	..	..	3,353
					Makatea ..	5,311										
Napier	..	..	..	..	..	..	151	..	50	..	..	25	..	750	..	..
Wellington ..	48	..	..	..	..	..	3,251	..	4,066	10	..	364	185	2,273	..	..
Nelson	10	..	..	..	..	..	275	..	200	..	..	45	10	..	..	..
					Walpole ..	1,600										
Lyttelton	210	..	..	..	Nauru	15,681	125	100	..	..	..	200	140	..	..	3,951
					Ocean	6,587										
Timaru	..	..	..	..	Walpole ..	657	10	15	..	..	..	60	10	..	..	..
					New Caledonia ..	950										
Dunedin	97	..	..	..	Seychelles ..	2,871	220	15	100	..	..	206	172	..	..	..
					Nauru	5,024										
					Ocean	2,276										
					New Caledonia ..	2,320										
Invercargill ..	80	..	..	..	Seychelles ..	2,610	350	75	1,120	..	..	648	480	2,956	..	..
					Nauru	2,015										

NOTE.—Importations of rock phosphate from United States, shown in last column, were made by the British Phosphate Commission to supplement its ordinary supplies from Nauru and Ocean temporarily held up by shipping delays due to bad weather at those islands.

POSITIVE AND NEGATIVE RESULTS IN FIELD EXPERIMENTS.

A "POSITIVE" result in field experimental work may be defined as one in which a treatment gives an increase irrespective of whether it is profitable or not; a "negative" result is one in which no benefit is derived from a treatment.

Great prominence is generally given to experiments which exhibit outstanding and visible positive results, especially if such results fit in with preconceived ideas of what should happen when any particular treatment is applied. On the other hand, very little is heard of those cases where negative or apparently negative results are experienced. These remarks apply in general to observational experiments such as those commonly conducted by farmers.

In the case of outstanding positive results the experiment, if in a prominent position, is self-advertising, and naturally calls forth comment and inquiry. In any case, the responsible individual generally feels rather proud of his achievement and loses no opportunity of bringing it to the notice of his fellows. The negative type of result is often lost sight of, chiefly because there is nothing to claim attention, and the individual concerned with the trial often considers his efforts wasted, becomes discouraged, and does not care to advertise his apparent failure.

It should be borne in mind that a negative result from a treatment is just as valuable a contribution to knowledge as is a positive one, for it is just as important to know when and where a certain application is likely to be of no avail as it is to know when or where it is profitable. In any case there are always certain departures from the general state of affairs. If results were always concordant there would be no need for other than the minimum of experimental work. Sir A. D. Hall, in referring to the truth of results of field experiments, has summed up the position in a very few words. He says: "There is no such thing as absolute truth, and what we want to find is that which is true as a whole, though it may be contradicted by parts of the whole."

It will be noticed that a distinction has been made between negative and "apparently" negative results. That a result is negative can only be determined by a carefully planned experiment. A difference to be visible, particularly in the case of a heavy crop, must be fairly considerable, and though not discernible by eye may be highly profitable. The same may apply to a lesser extent with a lighter crop. An example of such is recorded in last month's *Journal* (page 259) in the case of the pasture top-dressing experiment on the farm of F. W. Carpenter, Prebbleton, where both lime and lime plus super applications proved beneficial to a profitable extent when their effect was measured over two seasons. A more striking example is that recorded in the *Journal* for June, 1925, page 395, dealing with another top-dressing experiment, on W. G. Macartney's farm, Tai Tapu.

—A. W. Hudson, B.Agr., B.Sc., Instructor in Agriculture, Christchurch.

SEASONAL NOTES.

THE FARM.

WINTER TILLAGE.

DURING the coming month ploughing should be pushed ahead for spring crops as conditions permit, but never while the land is sodden. There is more latitude in the case of old pasture being turned, as this does not bake so readily if ploughed somewhat wet, but even so it should not show a glazey furrow.

In Canterbury and North Otago the breaking-up of grassland preparatory to the sowing of wheat should be carried out in winter. Through the action of frost having the beneficial effect of pulverizing the soil the maximum of water can enter, and storage of moisture against dry conditions which may ensue is greatly promoted. In cases where wheat has not been sown by about the middle of June it will be as well to postpone sowings until the beginning of August.

THE MANGOLD CROP.

If not already done, the next few weeks will provide a good period for pulling the mangold crop, so that the roots may have time to ripen before being fed. Some farmers are inclined to leave the roots in the ground, with the idea that they will grow a bit more. They may certainly grow a little, but the extra material will be of poor value. The best practice is to pull or harrow out the crop not later than June, screw or cut off the tops, and stack the roots in a good dry position, giving a light covering of straw or fern to keep out the frost. If the roots cannot be carted off, they should be thrown into rows in the field and allowed to ripen there. Where frosts are experienced there is danger of the roots being frosted during the first two or three days after pulling, but when they have been out for a week there is very little danger. The moral is not to start pulling during a spell of hard frosts, but to choose a time when there is every appearance of the weather being mild for a few days.

DRAINAGE.

Drainage should be given attention after heavy rains. In case of wet patches showing over known lines of underdrainage these places should be opened and examined with the object of remedying defects. A whole length of drain may easily be ruined by silting up.

Pastures that are apt to become sodden in winter are much improved by underdrainage, and mole ploughing is generally the cheapest method by which this can be accomplished. The value and effectiveness of mole ploughing on heavy retentive soil is not realized by many farmers. On such land surface water may often be found lying within 6 ft. of surface drains right up till late spring, and even then percolation is slow. Mole ploughing will remedy this. These drains last for a long period in stiff soil; but even if they have to be renewed every few years the operation may be reckoned a profitable undertaking.

LIMING AND MANURIAL TOP-DRESSING.

Liming may be continued during June. Stiff tenaceous clays can be greatly improved by lime, both in a mechanical and chemical sense, provided drainage is satisfactory. Manurial top-dressing also exerts its greatest influence when the soil has a sufficiency of lime, and stock are healthier. On these clays upwards of 1 ton per acre of burnt lime will greatly assist towards a better textured and freer working condition, while on the freer types of soil, but where excessive acidity is present, ground limestone is satisfactory.

Pasture top-dressing with artificial manures will still be in progress. Slow-acting fertilizers should now be applied as soon as possible if early benefit is to be expected.

SUPPLEMENTARY FODDERS.

From now on the growth of grass will be gradually falling to its winter minimum, and the supply of available fodders to both flock and herd should be correspondingly increased. The later-sown white-fleshed turnips will be nearing a finish, and the feeding of the swede crop probably started, while mangolds should be held in reserve for later use. In all cases a sufficiency of hay must be provided for the dairy herd, and sheep feeding off roots must be allowed a good run-off on pasture where the animals can provide themselves with the roughage so necessary to assist digestion. Intelligent and proper utilization of fodder crops means better health and a lowered death-rate among the stock.

Green catch-crops and temporary pastures sown in early autumn should soon be reaching usefulness, and if grazed lightly will also be of great assistance during the next two or three months.

The provision of ensilage deserves more attention than has hitherto been given to it, especially in those localities where spring cultivation is difficult, and where roots and other fodders are in consequence sown very late and the subsequent yields somewhat handicapped. Again, in such localities it is often difficult to feed off or cart out roots in the late winter and early spring, owing to the extremely wet condition of the land. Such country as a rule provides an overabundance of grass and clover growth during early summer, which could be preserved as ensilage and fed to stock as required in the lean periods.

TREE-PLANTING.

June is an excellent month for tree-planting on the farm, whether for shelter purposes, fencing-timber, or fuel. Hillsides which show signs of slipping and waste ground in various places may be profitably utilized in this manner, while the function of strong-growing trees in suppressing noxious-weed growth is also an important consideration. It is essential that all young plantations should be securely fenced from stock.

CONCRETE-WORK.

Concreting in cow-sheds, yards, &c., should be attended to early in the off-season, so as to give the work ample time to mature and harden before use. Where concrete is required to be moisture-proof, ½ pint raw or boiled oil per bucketful of material can be added.

—Fields Division.

THE ORCHARD.

CULTIVATION AND MANURING.

Ploughing, if not already commenced, should be put in hand at once, as recommended in last month's notes. It is advisable to plough to the trees, leaving an open furrow along the middle of the lands between the rows of trees, so that any water collecting in the open furrows may be as far away as possible from the main roots of the trees.

Where required lime may be applied to the soil at the rate of from 10 cwt. to 20 cwt. per acre. During the winter months slow-acting manures—such as blood and bonedust, at 2½ cwt. per acre; potash salts (30 per cent.), 1½ cwt.; and superphosphate, 3 cwt.—should be applied where such fertilizers are required, as they are not readily washed out of the soil and will be available to the tree-roots in the spring.

PLANTING.

The autumn planting-out of fruit-trees should be completed by the third week in May. Where this is not practicable planting should be delayed until the spring, when the ground has become reasonably dry and warm, so that the trees may quickly establish their roots in the new position in which they are placed. Plant as early in the spring as the situation will allow, and preferably before growth begins. On receipt of the trees from the nursery open them up, and if the roots are dry moisten them, and cover with moist sacking or straw; or if planting is not to be proceeded with immediately heel the trees in the soil. The roots should be exposed as little as possible to the sun or to the drying influences of the atmosphere. For heeling-in dig a shallow trench about 24 in. wide and 8 in. deep. The bundles should be opened and the trees set closely side by side in the trench. Shake loose soil among the roots until they are completely covered, and then firm the soil. As mentioned last month, the land should be well worked before the trees are planted. Deeply worked soil is very beneficial to the development of a good deep rooting-system, and to obtain this condition subsoiling is recommended.

The proper depth of planting is very important. Trees require to be planted at about the same depth as they were in the nursery. If they are planted too deeply they will not do well, and if planted too shallow they are liable to be blown over and to root-injury when the land is being worked. Dig the hole to the required depth and dimensions to accommodate the roots, break up the bottom of the hole, and leave the soil higher in the centre of the hole than towards the sides. Shorten back the roots, and pay particular attention to the removal of damaged and injured portions. Mix well into the soil to be used in covering the roots two or three handfuls of fertilizer, such as blood, bone, and superphosphate. Avoid bringing unmixed fertilizer in direct contact with the roots. Make the soil as firm as possible around the roots, so as to bring the soil in close contact with them and to hold the trees firmly in the ground.

The top of the tree should be pruned immediately after planting in order to ensure full success. In the transplanting from the nursery a very considerable portion of the root-system of trees is destroyed, and to offset this loss the top must be cut back.

GRAFTING.

In many orchards there are a number of unprofitable varieties of the various kinds of fruit being grown. It is recommended that such varieties be worked over in the spring to one or more of the varieties which are more profitable and suitable to present-day market requirements. These trees should be marked, so that time will not needlessly be spent in pruning them. Arrangements should be made at once for scions with which to do the grafting. The scion wood should be carefully selected from trees having the desired characteristics and a good cropping record. The wood should be of the past season's growth, dormant, at least the thickness of a lead-pencil, and well matured. Securely label each bundle of scions, and place them in sand in a shady and comparatively dry spot until required in the spring.

MARKETING.

The same careful attention is required in marketing the later varieties as was given to the earlier sorts. It is strongly recommended that all fruit which has been in storage for a time should be repacked, and unsound fruits removed. To some growers repacking may be a trouble, and on this account a number are disposed to avoid the additional expense and market their fruit without resorting to it. It is important that the store in which the fruit is held should be well ventilated, this being to some extent a prevention against rots and decay.

PRUNING.

This important seasonal operation is dealt with at some length in a separate article elsewhere in this issue of the *Journal*, to which orchardists are referred.

—W. K. Dallas, Orchard Instructor, Dunedin.

Citrus-culture.

Harvesting.—At this season it is advisable to pay careful attention to the fruit to be harvested. Poorman oranges may with advantage be allowed to condition on the tree; large sizes intended or suitable for dessert purposes may be left to attain full maturity. The longer they are allowed to remain on the tree the more palatable they become, and are consequently more likely to encourage consumption as a breakfast fruit and thus stabilize the demand. Smaller sizes for preserving should not be removed from the tree until a good deal of colour has developed, sufficient at least to give attractive appearance, and maturity enough to ensure that the fruits will improve in condition, not wilt and toughen.

Sweet oranges should be allowed to hang to mature, as flavour and sweetness become more pronounced than if the fruit is picked semi-

green and matured off the tree. On the other hand, overmaturity and dryness should be avoided; but this condition is not usual until new foliage appears on the trees during September, except when the fruit is frosted.

Lemons should be cut as the desired stage is attained and the fruit is changing from greenish-silver to light-yellow colour. These when cured and stored become better marketable fruits than those altered to yellow on the tree, apart from the drain on the vitality of the tree in maturing them. Periodic and prompt harvesting is very desirable during the winter season, in order to reduce to a minimum the skin blemish occasioned by chafeing under high winds and puncture from thorns on thorny varieties.

Brown-rot.—Under winter conditions citrus brown-rot is to be expected, and unless precautionary measures are taken, supplemented by control measures on appearance, this disease may do much damage to the grove. Control measures are of a threefold character: First, cut away any branches or twigs which are within 18 in. of the ground to minimize risk from spores splashed up. Secondly, apply pulverized sulphate of iron over the surface soil at the rate of 2 oz. per square yard, covering a rather larger radius than the spread of the tree, raking it in lightly to destroy spores which are resident in the soil. Thirdly, apply bordeaux 4–4–40 to trees at four-weekly intervals throughout the winter to prevent the establishment of any spores which may lodge in the fruit or foliage. All these measures are directed against spores which are present in the soil, having been deposited there by fallen fruit or leaves. The efficiency of the measures is prejudiced by allowing fallen fruit to decay about the trees, and non-attention to the collection and destruction of fallen diseased foliage.

Planting.—Land on which it is intended to plant citrus-trees this planting season should be prepared as soon as possible by deep cultivation and perfect drainage. If this work is done early the land will be prevented from becoming waterlogged, and will be in nice sweet condition for planting during spring.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

AUTUMN EGGS.

In poultry-keeping it is now recognized as an established fact that eggs must be produced in good numbers throughout the dear season if maximum returns are to be secured from the business. Obviously, there can be no comparison between a bird laying the bulk of her eggs during the dear season and one producing her main yield in the cheap season when practically any sort of fowl will lay. The fact of fresh eggs commanding such a high level of value during the recent autumn months is sufficient to indicate how many poultry-keepers there are who have yet to learn how to produce eggs at this season of the year.

At one time autumn-produced eggs realized but little more than those produced during spring and summer, but this has not been the

case during recent years. For example, during February, March, and April this year, the price of eggs in Wellington gradually rose till they were being retailed at 4s. per dozen. As a result those poultry-keepers who hatched out good numbers of chickens during July and who managed their flocks on proper lines reaped a good reward. These results were attained by reason of the fact that none but the late moulters—those birds which gave promise of being long-season layers—were retained in the flock. The early moulters and poor layers had been previously got rid of. Under this system of management, together with the high ruling price for eggs, a good margin of profit over and above the expenses of running the plant was secured. In fact, one big producer informed me that he secured his biggest weekly returns for eggs during the autumn months. This is a striking contrast to the returns secured on the great majority of plants at this period of the year, where the eggs gathered do not pay for the food consumed.

It may be contended that the bulk of the July-hatched pullets will moult in the late autumn, and that there will be a loss of winter eggs as a result. It is quite possible that they will, but on a well-managed plant there should be later-hatched pullets specially bred to lay during the cold months of the year. In any case the early-hatched pullets will not all moult and cease to lay at exactly the same time, providing, of course, they are properly fed and managed. With such birds it will generally be found that eggs in a more or less number will be obtained right throughout the dear season. Naturally, some of the birds will moult early and cease to lay, but others will continue producing, so that when the latter are moulting the former will have renewed their feathers and be ready to resume laying. Then again, owing to the fact of such birds moulting during the late autumn or early winter, they can usually be depended upon to lay well into the autumn or early winter during the following year when the price of eggs is on the up-grade.

Usually, the poultry-keepers' most lean period is from, say, the middle of March to the end of May or even June. The adult stock are then taking their period of rest, either preparing for or undergoing the moulting process. Further, probably owing to late hatching or through indifferent management, the pullets fail to produce when expected. This means that there is much money going out and little coming in. If the maximum returns are to be secured sufficient eggs should be collected to at least balance expenses. Just as the successful market-gardener aims at a rotation of crops and something to sell in each month of the year, so must the poultry-keeper organize a similar position if his business is to be really profitable.

Almost daily I receive complaints from poultry-keepers who have tried to secure eggs in the dear season but have failed in their objective. Usually, this is put down to the same old trouble—namely, bad luck—and so it goes on from year to year. There are others, however, who combine common-sense management with strict attention to details, and who conduct the business in a methodical manner. These somehow never have the so-called "bad luck." At times, of course, they make mistakes, but these are seldom of any moment. They succeed in the little things that really matter, and

thereby make poultry-keeping the profitable business it is to those who thoroughly understand it, and treat it as a serious proposition to be mastered and conducted on the same strict business principles as any other rural industry.

After all, there is no great secret in securing autumn or winter eggs. These can be produced without fail by following rules which, when combined with common-sense, are simple and easily effected. To those who have asked my advice relative to pullets failing to lay when expected, and others who have had a similar experience, I would suggest that they ask themselves the following questions: When were the pullets hatched too early or too late? Were they bred from tested winter-laying stock? Were they properly reared? Was the class of food altered too often, or was an inferior food purchased because it was cheap? Was old wheat suddenly changed to new wheat (a common cause of poultry moulting)? Did the birds receive a regular supply of animal food, so imperative for the production of eggs in the dear season? Were green food, grit, and clean water always available? Did the birds contracts colds and spread them through the flock, by reason of a draughty house and failure to find the cause, or were the houses overcrowded or insufficiently ventilated? Were the birds and houses infested with vermin? Had the runs been allowed to become poultry-sick, and were the birds infested with intestinal parasites from this cause, or was there any attempt made to run the pullets on clean ground so essential for their welfare?

Even these questions do not cover the whole field which calls for investigation to account for much of the so-called bad luck. It may be taken for granted that if the birds are well housed, well fed, and generally receive common-sense management, and yet do not lay well, they are a poor laying strain. In such cases the best remedy is to get entirely new blood of a strain noted for egg-laying power.

TIME TO MATE.

It should not be forgotten by poultry-keepers who desire to secure a good yield of eggs in the autumn of next year that the breeding-pens should be mated up during the coming month. This will give the birds an opportunity of getting well settled down, so as to enable chicks to be hatched out early in July. It may be mentioned in this connection that adult birds are seldom laying at this period of the year, and in order to secure early chicks the poultry-keeper is obviously forced to use pullet-eggs for incubation. Breeding from pullets is not generally recommended, but for the production of winter eggs an exception must be made.

When using pullets for this purpose special care should be taken that they are well developed and possess strong points indicative to constitutional vigour, such as bright prominent eyes, well-developed crop, tight feathering, and generally an active businesslike appearance. When pullets are to be bred from they should be mated, where possible, with an adult male. Breeding from pullets and cockerels should be avoided wherever possible.

Unfortunately, many who depend on the natural mother for rearing chicks are forced to hatch late owing to their inability to secure broody

hens. One means available to the small poultry-keeper for overcoming this difficulty in timely hatching is the securing of day-old chicks from reliable specialists in the production of heavy-producing stock. Such chicks can be satisfactorily reared with a fireless brooder, provided the necessary attention is available, while there are also more or less inexpensive lamp-brooders on the market which can be depended upon to give good results.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

TREATMENT OF WAX.

AFTER the honey crop is disposed of and the bees are settled snugly in their winter quarters the beekeeper should give attention to clarifying his wax. Where a solar extractor has been used during the summer it will be a simple matter to collect the cakes of wax which have been melted in this manner and reduce them to one or two large cakes; but where a number of combs is to be treated a wax-press is an almost indispensible article in the apiary equipment. For handling wax in large quantities the press now known as the Root wax-press is best. No special building is needed for wax-melting; an ordinary washhouse answers the purpose admirably. Choose a cold day for the operation, since nothing excites the bees during the off season like the smell of hot wax.

Commencing operations, fill the copper half full of water, and when this is heated place the combs—which must have been removed from the frames—in the hot water. Have a strong stand ready to support the wax-press, and inside this place a kerosene heater, so arranging it that the flame comes in direct contact with the bottom of the press. Fill the water-compartment of the press with boiling water, which the heater will now keep boiling, and in the perforated basket of the press place a coarse scrim bag large enough to reach to the bottom of the basket. The combs in the copper should be stirred with a stick until the wax is all melted, and the contents of the copper —water and wax—should then be ladled into the scrim bag in the press. The top of the bag should now be folded so as to allow of one or more of the wooden "followers" belonging to the press to be placed on top of it and the screw placed in position, when a stream of water and wax will immediately commence to flow from the outlet provided in the press. A kerosene-tin or similar vessel should be placed in position under the outlet.

Two precautions are necessary in using a wax-press. Pressure should at all times be applied with caution. Until the flow from the press slackens the screw should not be turned, and when it becomes necessary to apply pressure this should be done without appreciable effort. The screw should always turn easily. It will be found that if this advice is taken the maximum of wax will be obtained with very little risk to the machine. Another point to be borne in mind is that only a comparatively small quantity of water and wax must be put into the bag at each ladling. It is difficult to exactly estimate how much to treat at once, so much depends on the proportions of

wax and water, but on no account attempt to fill the scrim bag at one operation. When the wax and water cease to run from the outlet the bag should be removed and the slumgum emptied out before the press is required to deal with any more wax.

As the copper will contain a great deal of water it is an excellent plan to keep a kerosene-pump in the vessel placed to receive the contents of the press. If this is sunk to the bottom of the vessel it will draw off a great deal of the water, leaving the wax, which will, of course, be on top, untouched. This will result in the wax being gathered in far larger cakes then if several vessels are used. The wax should be set aside to cool as gradually as possible, this being best achieved by covering the tin containing it with corn-sacks or similar material. The gradual cooling helps to clarify the wax. When it is quite cold the cake should be taken out of the tin and carefully scraped.

The tin should now be washed out and partly filled with clean hot water, the cake of wax replaced, and the whole gradually heated until the wax is once more melted. After this second process the whole should be slowly cooled as before, and when the wax is once more removed and scraped it will have reached its commercial form. The wax-press and copper should be cleansed while still hot. The water should be emptied out of its compartment in the press at once, and the press placed to drain in order to prevent rust. The slumgum must be gathered up and burnt, and the bag washed and dried for future use.

BEEKEEPERS' CONFERENCE.

The annual conference of beekeepers will be held at Christchurch on 7th, 8th, and 9th June. It is expected that all parts of the Dominion will be represented. Papers in connection with the Hopkins memorial scheme will form a feature of the Conference. This year's subject is "The Economical Production of High-class Honey for Export." Competitions for the best collection of honey-producing plants, marked and correctly named, also for honey and beeswax, are to be held.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

THE HOMESTEAD GARDEN.

MOST farm homes have a garden, as it improves the appearance and value of the property, besides giving pleasure to its members. Practically all the requirements of a garden are at hand, and an ample and seasonable supply of fruit and vegetables is among the advantages of country life. In some instances, however, this pleasure and profit are at a discount, and work in the garden is unpopular. Why should this be so? In most cases it is due to the moderate results obtained, owing to the design being complicated, with a number of narrow borders and small beds filled with a large collection of herbaceous plants, shrubs, and weeds. The temptation to plant a little of everything that appeals to one's taste is hard to resist—a corner is found, and in it goes to

make the confusion worse. This practice results in chaos and weeds—hence the discouragement. It is very true that nothing succeeds like success, and effective results are required to inspire that enthusiasm which will make the work popular and give the worker pride in his achievement. These results are readily obtained if a convenient, simple design is carefully thought out first and carried out afterwards. The present time is very suitable for making such alterations.

Dry paths are required, but too frequently there are far too many of them. They demand a great deal of attention to keep them effective and looking well, while it is to be remembered that good short grass is much pleasanter to walk on, and on very few occasions it is unpleasantly wet. Only where the traffic is so great as to wear a track should a path be made, and with this rule operating very few will be required.

The home gardener is wise in cutting up his lawns as little as possible by forming his walks and drive as far as can be about the sides of the lawn. And where the lawn and the walk meet a neat outline is secured by a short grass verge, but where it runs beside a shrubbery or herbaceous border a problem arises that is not always very successfully dealt with. An edging of sawn timber which is so commonly used is not satisfactory for long; the conditions soon cause it to warp and decay, and so it contributes to discouragement. In large gardens a strip of grass 2 ft. or 3 ft. wide usually solves the problem, but that is rather difficult to lay down, and requires a great deal of work to maintain. A rock verge is sometimes used, but in flat country it looks a little out of place, although in broken rocky country it may very well be used with best results. Otherwise, if the walk or drive is adjoining a shrubbery, dwarf shrubs, such as the veronicas of different species, and senecios, planted close enough to touch, give an evergreen definition that is effective with little labour. Where an herbaceous border adjoins the path an evergreen carpet-plant, such as pinks, mossy phlox, or violets, serves the purpose.

This brings one to the most unsatisfactory sections of the type of homestead garden with which we are dealing—those miscellaneous collections of herbaceous and bulbous plants matted up with twitch-grass and sorrel. This material is best dealt with now by lifting the whole lot out and carefully sorting the good plants from the weeds before heeling them in a piece of spare ground. Some of the little beds and narrow borders will be best laid down in turf after firming and levelling the soil.

The area selected for the herbaceous border, while prominent and bold in outline, should be moderate in extent. Although it makes a good foreground to the tall shrubbery border, there is a tendency to make this a rule, and as a result the area devoted to this purpose is comparatively too great. By confining this class of planting to a border or two close by the house and the margin of one or two of the more prominent shrubberies not only is the amount of work greatly reduced, but a varied interest is also created that is more attractive.

Having decided on the localities for these borders, they should be carefully outlined and properly trenched with a generous application of fermented organic manures worked into the lower spit. It may not be superfluous to remark here that all twitch and such bad weeds should be carefully picked out, as this is most important. After trenching the

ground do not be in a hurry to plant; let the land settle, any weed-seeds germinate, and roots of weeds sprout, so that they can be dealt with; thus the land may be thoroughly cleaned. After this a heavy dressing of blood-and-bone manure, 4 oz. to the square yard, may be lightly dug in, and shortly before planting an application of 2 oz. superphosphate per square yard may be hoed in. Planting may then be done at any time when the land is dry. Effective appearance and economy in maintenance will be best obtained by arranging the different varieties and species of herbaceous plants in rather large irregular groups than in mixing them together in the usual way. The blossom-colours show up brighter in that way, and the contrasts and harmonies may be made to which the effect is due. Plant so that when the plants are in full growth the ground is covered with foliage; it looks better, and there is very little weeding to be done. All that is required is to restrain the exuberance of some of the more vigorous members.

The Vegetable Section.

The unsatisfactory vegetable section in the homestead garden is usually one in which short rows of vegetables in considerable variety are mixed with bush fruits in such a way that little or nothing does really well, and what poor achievement is secured is at the expenditure of a great deal of back-aching hard work. Such a state of affairs may be often best dealt with here by dispensing with the annual vegetable crops altogether, and devoting the area to bush-fruits, strawberries, herbs, and such permanent crops as rhubarb and asparagus. Such an association can be made with every prospect of success.

For the family vegetable-supply it is recommended that an area adjoining the annual farm root crops should be reserved, even if it be only the headlands of the paddock. Planted in rows rather long and wide, most of the work may be done by horses more expeditiously, and most of the distasteful tedium avoided. On most farms a crop of mangolds and carrots are required for the stock, and to extend the planting with vegetables for household requirements has been proved a very satisfactory practice.

QUALITY AND SUITABILITY OF SEED.

It is a fact that strangely few planters give the requisite attention to the characteristics of the seed they purpose to sow. Too often the result is a thin crop of moderate quality, afflicted by disease, a source of anxiety, and requiring extra manures and a great deal of spraying to attain merely a moderate result. The calamity varies from time to time, and assumes a number of different distressing features that lead to a heavy correspondence with those who undertake to give horticultural advice. Of the various factors that contribute to successful cropping, that of the seed is one of the most important, and is quite often entirely overlooked. A sower should assure himself that the seed he is planting is the most suitable variety for the place and purpose, that it is of high strain, free from disease, and of a known percentage of germination. The importance of each of these points will vary with the different kinds of seeds dealt with. It is specially desirable to know the germination percentage, as it is then possible to adjust the drills

to sow at a rate that will give an even stand with little or no thinning, and thus secure a very great economy.

Potato-seed strain is often deficient, and scab, wilt, rhizoctonia, and late-blight diseases are sometimes found among them. Through being heated and stored in the dark, potato-seed is sometimes devitalized by making long premature growth that renders it comparatively useless for seed purposes. Clean potato-seed of a good variety and strain should be obtained early in the season and now stored in a light airy cool position. These conditions will protect and ripen the buds in the eyes of the potatoes, and induce a short strong growth at the right season.

—*W. C. Hyde, Horticulturist.*

IMPORTATION OF HAY, STRAW, OR CHAFF.

THE regulations under the Stock Act, gazetted on 6th March, 1924, in so far as they relate to hay, straw, or chaff used as packing or otherwise with goods imported into New Zealand from Great Britain, Ireland, and the Continent of Europe, were revoked as from 25th March current, and the following regulations have since applied :—

1. The importation into New Zealand, either direct or by way of any other country, from Great Britain, Ireland, any part of the Continent of Europe, Argentina, Uruguay, Paraguay, Brazil, and Chile, of hay, straw, or chaff is hereby prohibited, save with the consent of the Minister of Agriculture, except where such introduction takes place in accordance with these regulations : Provided that these regulations shall not apply to any articles of millinery or other articles constructed wholly or partly of braided, interwoven, or plaited straw.

2. Hay, straw, or chaff used as packing-material for goods manufactured and packed in Great Britain may be imported upon production to the Collector of Customs at the port of entry of a certificate or declaration, either on or with the invoice from the exporter or packer, countersigned as correct by a responsible officer appointed by the High Commissioner for New Zealand for the purpose, to the effect that the hay, straw, or chaff used has been either—(*a*) Subjected to the action of live steam, and maintaining in all parts of the compartment a temperature of not less than 185 degrees Fahrenheit for a period of at least ten minutes ; (*b*) placed loosely in a tight compartment having a temperature of not less than 65 degrees Fahrenheit, and thoroughly sprayed with 10 fluid ounces of formaldehyde solution (containing not less than 37 per centum of formaldehyde by weight) for each 1,000 cubic feet of space in the compartment, which was immediately closed in a manner to prevent the escape of the formaldehyde vapour, and kept closed for not less than 8 hours ; or (*c*) placed loosely in a tight compartment and subjected to the action of heat in the presence of moisture at a temperature of not less than 260 degrees Fahrenheit, and maintaining this temperature throughout the whole of the chamber for a period of not less than two hours.

3. Where material of any kind other than hay, straw, or chaff disinfected and certified in accordance with clause 2 hereof is used for the packing of any goods imported from the countries hereinbefore mentioned, a certificate or declaration as to the nature of such material shall be endorsed on the invoice accompanying such goods, and be signed by the exporter or packer.

4. Straw envelopes intended for use in packing bottles may be imported from Great Britain upon production to the Collector of Customs at the port of entry of a certificate or declaration similar to that prescribed in clause 2 hereof.

5. Every person who commits a breach of these regulations shall be liable to a penalty of not less than £2 nor more than £100.

The regulations are an additional precautionary measure against the introduction of foot-and-mouth disease into this country.

VETERINARY SURGEONS REGISTRATION REGULATIONS.

THE following regulations under the Veterinary Surgeons Act, 1926 (which was published in full in the *Journal* for November last), have been gazetted :—

1. PRELIMINARY.

These regulations may be cited as the Veterinary Surgeons Registration Regulations, 1927.

2. INTERPRETATION.

In these regulations, if not inconsistent with the context,—

"Board" means the Veterinary Surgeons Board constituted under the said Act :

"Registrar" means the Registrar appointed under the said Act :

"Veterinary Surgeon" means any person duly registered under these regulations.

3. TRAVELLING AND LOCOMOTION EXPENSES AND FEE FOR ATTENDANCE.

(1) The Board may pay to any member of the Board all travelling and locomotion expenses actually and reasonably expended by him in respect of attendance at meetings of the Board.

(2) No claim of any member for travelling or locomotion expenses shall be recognized unless such claim shall be accompanied by a certificate of such member, setting out that he was engaged in connection with the business of the Board during the period claimed for. Such certificate shall be in the following form :—

> I, [*Full name, occupation, and address*], hereby certify that I was engaged in connection with attendance at meetings of the Veterinary Surgeons Board on the day claimed for, and incurred the travelling and locomotion expenses indicated in the claim.

(3) No payment of expenses under these regulations to any member shall be made unless such payment is first approved by a resolution of the Board.

(4) The Board may pay to any member of the Board, not being a person in the employment of the New Zealand Government, the sum of two guineas for each day or part of a day while attending the meetings of the Board.

4. APPLICATION FOR REGISTRATION.

(1) Application for registration of veterinary surgeons shall be in accordance with Form A in the Schedule hereto.

(2) Any notification required by the said Act or these regulations to be given to any applicant for registration, whether before or after registration, shall be sufficient if sent by registered-post letter signed by the Registrar and addressed to the applicant at the address stated by him in his application, or any fresh address notified as hereinafter provided.

(3) Any document submitted with an application for registration may be returned to the applicant by registered-post letter to the address given in the application, or to any fresh address notified as hereinafter provided.

(4) Any applicant may, either before or after registration, by writing addressed to the Board, notify a fresh address, and the Board may direct an entry of such fresh address to be made in the register.

5. REGISTRATION OF VETERINARY SURGEONS.

(1) The Register of Veterinary Surgeons referred to in section 5 of the said Act shall be kept in accordance with Form B in the Schedule hereto.

(2) The entries in the register shall be made in the order in which the directions to make the entries given under section 7 of the said Act are received by the Registrar.

(3) The Registrar shall also keep (either bookwise or by means of a loose-leaf or card system) an alphabetical index of the names of the persons entered in the register, and such index shall be deemed to be a part of the register.

(4) The qualifications by virtue of which a person is registered shall be sufficiently indicated by the usual abbreviation of any recognized certificate (including an indication of the institution by which the certificate is granted).

(5) The direction in writing of the Board referred to in section 7 (2) of the said Act shall be sufficient if signed by the Chairman and given pursuant to a resolution of the Board.

(6) The certificate of registration issued under section 8 of the said Act shall be in accordance with Form C in the Schedule hereto.

(7) Any person may, on payment of the fee hereinafter prescribed, obtain a copy, certified under the hand of the Registrar, of the particulars entered in the register in respect of any person.

6. CANCELLATION OF REGISTRATION.

(1) The name of every person removed from the register under section 10 of the said Act shall be published in the *Gazette*, and the Board may, if it thinks fit, state the ground of such removal.

(2) Such publication shall take place after the time for appeal under section 11 of the said Act has expired, or, if an appeal is lodged, after the decision of the Board of Appeal has been given or such appeal has been otherwise disposed of.

(3) Every certificate of registration issued to any person whose name is removed from the register as aforesaid shall be returned to the Registrar by such person within one month from the date of the publication in the *Gazette* of the notification aforesaid.

(4) Every person who, without just cause, fails so to return any certificate shall be liable to a fine not exceeding £5.

7. FEES.

(1) The fee for registration, including a certificate of registration, shall be £2 2s., which must accompany the application for registration.

(2) The fee for publication in the *Gazette* of the name of a registered veterinary surgeon shall be 5s., to be paid before the 1st March in each year.

(3) The fee for a certified copy of an entry in the register shall be 5s.

(The Schedule is not printed here; the form of application for registration may be obtained from the Registrar, Veterinary Surgeons Board, Department of Agriculture, Wellington.)

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 10th March to 5th May, 1927, include the following of agricultural interest:—

No. 55322: Treatment of meat; J. A. Linley, London, England. No. 55340: Flax-treating; G. Craw, Linton. No. 55815: Milk-agitator; J. Feaver, jun., Opunake. No. 56340: Onion-topping machine; W. R. Curtis, Christchurch. No. 56431: Milk-purifier; F. O. Carbines, Auckland. No. 57754: Hay-lift; J. Hodson, Bannockburn. No. 56435: Cream-cooler; A. Coutts, Hukerunui. No. 57500: Sheep-shears; Chicago Flexible Shaft Co., Chicago, U.S.A. No. 57970; Fertilizer-distributor; May Brothers, Ltd., Gawler, S. Australia. No. 56361: Dehorning cattle; S. Armstrong, Tuhikaramea. No. 56429: Cleaning milk-cans; Watson, Steele, and Ganley, Ltd., Auckland. No. 57563: Manure-distributor; L. I. Howell, Paraparaumu. No. 55471: Transferring mutton from wharf to ship; J. Crestofanini, Christchurch. No. 55765: Subsoiling-device; R. L. C. Drummond, Riwaka. No. 56639: Teat-cup inflation-ring inserter; T. N. Drummond, Hamilton. No. 57730: Milking-machine pulsator; R. Wallace, jun., Castle Douglas, Scotland. No. 58120: Spraying-apparatus; W. J. Denston, Birmingham, England. No. 55189: Dehorning cattle; H. Preston, Masterton. No. 56263: Gardening tool; W. Beamish, Hastings. No. 58097: Harrow; F. T. F. Evans, Auckland. No. 58174: Manure-sowing machine; L., B., G., and I. P. Hayes, Oturehua.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the Bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FUNGUS DISEASE IN ARTICHOKES.

F. P. LEA, Leamington :—

I would be obliged if you could tell me of a remedy for a disease which is affecting a crop of artichokes. For about a month past quite a few plants have been turning black in the leaf and dropping to the ground. The first indication of disease is apparent about 2 ft. from the ground, when the stalk goes dry and brown, followed by a withering of the leaves, and the tubers turn into a kind of milky pulp.

The Fields Division :—

The specimens sent are attacked by the fungus *Sclerotinia sclerotiorum*, an infection which is becoming rather common in artichoke crops. As the crop is no doubt ready for feeding off with pigs, there is a probability that the disease will spread throughout the patch. We would suggest that you plant a fresh area on clean ground, using seed taken from healthy plants. For greater safety, tubers should be dipped in formalin solution, 2½ per cent. strength, before planting. All diseased stems in the affected crop should be pulled and destroyed by burning, as they help to spread the disease. Artichokes should not be sown again for five years in land known to be infected.

FERMENTING OF HONEY.

"BEEHIVE," Hakaru :—

Can anything be done to honey which has fermented, and what is the cause of fermentation ?

The Horticulture Division :—

If the honey has not turned sour the slight alcoholic ferment can be evaporated readily by melting over water, when the ferment escapes in the shape of foam. Honey, if not kept in airtight vessels, readily absorbs moisture from the air, and fermentation sets up. When removing honey from the hive see that the cells are all capped, or the unripe honey stored in the open cells will cause fermentation.

TREATMENT FOR DANTHONIA PASTURE.

"NORTH AUCKLAND," Waipu :—

I should be glad to know of the best treatment for pasture consisting of nearly pure *Danthonia pilosa*. I have about 50 acres of it, and the ground is clean, undulating, and ploughable. Owing to the grassland having been burnt and reburnt, other grasses have disappeared. The farm is about 300 acres, and all requires top-dressing. I believe poor ground should be dressed first, as stock will eat out the grass in good valleys in any case. Can I improve the danthonia with top-dressing ; and to produce good mixed pasture shall I require to surface-sow a mixture ? I do not wish to plough the land, although doubtless this would be the better plan.

The Fields Division :—

No doubt the continual burning-off of the danthonia has killed out the vestiges of English grasses which usually persist in such a pasture when not burnt, and resulted in the reduction of the surface fertility (especially the humus content) to much below the standard required by rye-grass and white

clover. Therefore top-dressing alone will not effect much improvement in the pasture beyond producing a more vigorous and palatable growth of danthonia, and probably bringing in *Lotus hispidus*. For the same reason the sowing of English grasses with the top-dressing is not advisable on the surface as it is. Heavy disking and tripod harrowing to break up the danthonia, and render some of it available as humus, as well as provide a better seed-bed for the following mixture (to be sown with the top-dressing) is recommended: Italian rye-grass, 2 lb.; perennial rye-grass, 6 lb.; crested dogstail, ½ lb.; paspalum, 2 lb.; white clover, 1 lb.; a few ounces of subterannean clover per acre can also be included. A pasture renovated in this way would gradually improve with top-dressing. An alternative which may fit in with the farm-management is to plough and take a crop of soft turnips or rape, which should pay for the initial cultivation. After the crop is fed off about February and March, preferably with sheep, the land can be disked and sown with a permanent grass mixture, the crop residues and dung enriching the surface. This method would give a much better pasture. However, since this is presumably the poorest pasture on the farm and cannot be producing very much, it would be a much-better-paying proposition to commence top-dressing the better pastures, as they will give more economical and quicker returns for the expenditure. It is not so much a question of what the stock will eat as getting the most out of what they do eat, and it will be found that by top-dressing the poorer portions of a pasture a little more heavily the stock will tend to graze the whole of the pasture so treated fairly evenly. The renovation of the danthonia paddock might well be left until the rest of the farm is brought into good heart.

BACON-CURING.

D. WITHERS, Paparoa :—

Kindly suggest a mild cure for pigs of about 200 lb. dressed weight, the bacon not being required to keep more than three months.

The Live-stock Division :—

There are two forms of curing for bacon—dry curing and brine curing—good recipes for both of which are appended. For a mild cure either way do not let the bacon pieces remain in salt as long as the times stated in either formula.

(1) Dry curing: Weigh out for each 100 lb. meat 5 lb. salt, 2 lb. brown sugar, and 2 oz. saltpetre. When the carcase is thoroughly set cut up and salt lightly, then lay it upon a clean concrete floor or table overnight. By "salt slightly" is meant that as much salt as will cover the meat comfortably without undue waste is used. Next morning brush the salt off thoroughly, then salt the meat with dry salt and brown sugar, rubbed well in daily for three days. On the fourth and fifth days a little saltpetre should be added to the salt and sugar, which should be well rubbed in, especially on the skin. Leave the bacon and hams in the mixture (dry salt and brown sugar) for about three weeks; but the hams and bacon should be turned every day or second day, and at the same time rubbing continued during this period. Wash clean when the pieces are ready for smoking, the duration of which depends upon the taste of the manufacturer. After the first week or ten days it is advisable to brush the salt and sugar off the inner side of the thin parts of the bacon (flaps). Dry salting should be undertaken only in cold weather and in a cool place.

(2) Brine curing: Pack the properly cooled meat into a clean barrel and pour over it the prepared brine. For making the brine, take 8 lb. salt, 2 lb. sugar, and 2 oz. saltpetre, and dissolve in 4 gallons of water for every 100 lb. of meat; make overnight and pour in when properly cooled. Small pieces can remain in the brine for six weeks, while larger pieces or hams may stay eight weeks. The barrel should be placed in a cool cellar if possible, or in any other cool place available. Success depends upon getting the animal heat out of the carcase, assuring that the meat is properly cooled and well set before adding the brine.

WEATHER RECORDS: APRIL, 1927.

Dominion Meteorologocal Office.

GENERAL SUMMARY.

RAINFALL in April was below the average in most parts of the country, and mean temperatures were lower than usual. Cloudy skies were much in evidence in the northern districts, but bright sunshine was above the average in other parts.

High westerly winds were prevalent in the South Island, especially between the 5th and 15th, and from the 22nd to the 26th. The month closed with wintry weather, while a storm area passed slowly to the eastward of the Dominion.

RAINFALL FOR APRIL, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	6·66	13	2·34	3·55
Russell	4·49	12	1·50	3·90
Whangarei	3·06	13	1·38	4·43
Auckland	3·93	18	0·58	3·46
Hamilton	3·02	17	0·65	3·86
Kawhia	4·90	17	0·66	4·75
New Plymouth	4·52	20	1·15	4·54
Riversdale, Inglewood	5·57	20	0·86	8·39
Eltham	4·14	15	0·67	5·16
Whangamomona	4·13	16	0·65	6·68
Tairua	2·42	8	0·66	5·88
Tauranga	4·36	13	1·51	5·08
Maraehako Station, Opotiki ..	3·18	9	0·82	4·57
Gisborne	1·77	8	0·39	4·20
Taupo	2·21	8	0·50	3·95
Napier	1·44	13	0·46	2·92
Maraekakaho Station, Hastings ..	1·78	10	0·47	3·14
Taihape	3·78	18	0·86	3·15
Masterton	2·97	12	1·45	3·04
Patea	3·89	15	1·35	3·95
Wanganui	2·02	10	0·50	3·37
Foxton	1·86	9	0·80	2·47
Wellington	1·53	11	0·41	3·80
South Island.				
Westport	4·79	20	1·30	6·50
Greymouth	9·37	18	1·80	8·37
Hokitika	9·78	18	2·12	9·38
Ross	12·19	17	2·77	12·55
Arthur's Pass	16·67	15	4·95	16·16
Okuru, Westland	12·66	15	3·18	13·67
Collingwood	6·64	13	1·94	8·07
Nelson	2·02	6	0·92	2·93
Spring Creek, Blenheim ..	1·16	9	0·85	1·91
Tophouse	3·78	15	0·85	4·22
Hanmer Springs	1·13	7	0·43	3·12
Highfield, Waiau	1·00	6	0·30	2·66
Gore Bay	1·82	9	0·56	1·77
Christchurch	1·13	10	0·29	1·97
Timaru	0·84	10	0·22	1·51
Lambrook Station, Fairlie ..	1·17	4	0·65	1·95
Benmore Station, Clearburn ..	1·55	7	0·39	2·52
Oamaru	1·60	7	0·58	1·78
Queenstown	3·62	8	0·80	2·92

RAINFALL FOR APRIL, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
South Island—continued.				
Clyde	1·24	6	0·76	1·34
Dunedin	2·08	11	0·54	2·82
Wendon	1·74	10	0·26	3·36
Gore	2·17	17	0·45	3·29
Invercargill	4·16	23	0·75	4·36
Puysegur Point	11·68	23	1·42	7·98

—*D. C. Bates, Director.*

FORTHCOMING WINTER SHOWS.

Otago A. and P. Society: Dunedin, 31st May to 3rd June.
Waikato Winter Show Association: Hamilton, 31st May to 4th June.
Manawatu A. and P. Association: Palmerston North, 14th to 18th June.
Rotorua A. and P. Association: Rotorua, 21st to 23rd June.
South Taranaki Winter Show Company: Hawera, 29th June to 6th July.
Wellington Winter Show Association: Wellington, 15th to 30th July.
Auckland Winter Exhibition: Auckland, 21st to 30th July.

Secretaries are invited to supply dates of their shows for publication in this list.

REDUCTION IN PRICE OF STRYCHNINE.

In connection with the sale of strychnine to settlers for poisoning of rabbits, the Department of Agriculture has reduced the price of alkaloid powdered strychnine (British manufacture) in 1 oz. bottles from 3s. 6d. per ounce to 3s. per ounce. It may be mentioned that an article on Rabbit-poisoning with Strychnine, describing the various baits and methods, was published in the *Journal* for January, 1924, and reprinted in pamphlet form.

List of Shows, Exhibitions, &c.—The International Chamber of Commerce, British National Committee, have requested the High Commissioner in London to supply to them a list of agricultural shows, winter shows, exhibitions, fairs, Empire weeks, and other fixtures of a similar nature, to be held in New Zealand during 1928. The information is required as soon as possible for inclusion in the published list of the International Chamber of Commerce this year. The Department of Agriculture has circularized all incorporated agricultural and pastoral associations, also winter show organizations, in the Dominion, requesting the supply of the information to the Department for transmission to London. Any organization in question not reached by this circular is asked to communicate with the Department at Wellington.

Correction.—In the *Journal* for December last, page 396, the true bushel-weight of oats was printed as ranging from 65 lb. to 68 lb.; the figures should have been 35 lb. to 64 lb.